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CONTENTS

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THELOPSIS ISIACA VAR. *AUSTRALIS*, A NEW PYRENOCARPOUS LICHEN FROM AUSTRALIA

by

P. M. McCarthy*

ABSTRACT

McCarthy, P.M. *Thelopsis isiaca* var. *australis*, a new pyrenocarpous lichen from Australia. *Muelleria* 7(3): 313-315 (1991) — *Thelopsis isiaca* var. *australis* McCarthy is described from west-central Victoria, Australia. It is distinguished from var. *isiaca* by its well-developed areolate thallus, smaller asci, perithecia and thalline verrucae and its occurrence on deeply-shaded siliceous rock. *Thelopsis* Nyl. is reported from the Southern Hemisphere for the first time.

INTRODUCTION

The pyrenocarpous lichen genus *Thelopsis* Nyl. is best known from Europe (Vězda 1968) and the U.S.A. (Harris 1979). Accommodating six species, it is characterised by a *Trentepohlia*-like photobiont, polysporous unitunicate asci, simple persistent paraphyses and simple to few-septate ascospores. This combination sets *Thelopsis* apart from all of the recognised pyrenocarpous families (Harris 1979).

The rarely-collected *T. isiaca* Stizenb. is the only species with 1-septate spores, but, more significantly, it is the only one possessing perithecia that remain entirely immersed in prominent thalline warts. *Thelopsis isiaca* has been found in Egypt (its type locality), Crete, SW Europe and California, U.S.A. (Vězda 1968); it is predominantly corticolous, but is also known to inhabit limestone and other basic rocks. *Thelopsis isiaca* var. *australis*, described here from Victoria, represents the first record of this anomalous genus from the Southern Hemisphere.

TAXONOMY

Thelopsis isiaca var. **australis** McCarthy, *var. nov.*

Thallus crustaceus, epilithicus, subgriseo-hinnuleus, areolatus, 0.1–0.15(–0.2) mm crassus. *Areolae* irregulares, angulares, laeves, hebetatae, planae vel convexae, saepe rimulosae, 0.2–0.5(–0.6) mm latae. *Cortex* 35–45 μm crassus, magnopere hyalinus. *Stratum algarum* 50–90 μm crassum; cellulae ad *Trentepohliam* pertinentes, 10–23 × 10–16 μm. *Medulla* 20–40 μm crassa. *Perithecia* simplicia, in verrucis thallinis omnino immersa, plerumque solitaria. *Verrucae* convexae vel hemisphaericae, (0.38)–0.45(–0.56) mm diametro. *Ostiolum* leviter depressum, fuscatum. *Centrum* globosum, 0.2–0.25(–0.3) mm diametro. *Excipulum* hyalinum, 20–30 μm crassum. *Periphyses* 20–30 × 1.5–2.5 μm, parce ramosae. *Paraphyses* simplices, multicellulosae, persistentes, 2 μm latae. *Asci* unitunicati, cylindrici vel fusiformes, 60–120-spori, 130–160 × 12–20 μm, apicibus gradatim decrescentibus vel rotundatis vel parce complanatis. *Gelatinum hymenii* kali causticum/J+ sublazulinus. *Ascosporae* incoloratae, 1–septatae, latae vel elongatae-ellipsoideae, aliquando moderate flexae, aliquando cellulis anisomorphis, plerumque in medio constricto, persaepe biguttulatae, (9.1–)12.2(–17.3) × (4.4.–)5.4(–7.1) μm.

HOLOTYPUS: Australia, Victoria, 4 km SSW of Mt Langi Ghiran, 300 m N of Beaufort-Ararat road, alt. 450 m, on dry deeply-shaded granite, *P. M. McCarthy 122* (MEL 1052235).

Thallus crustose, epilithic, pale grey-fawn, areolate, 0.1–0.15(–0.2) mm thick. *Areolae* irregular, angular, smooth, matt, plane to convex, frequently

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rimulose, 0.2–0.5(–0.6) mm wide. *Cortex* 30–45 μm deep, mainly hyaline, pigmented only in the uppermost 5–7 μm; cells become larger, more angular and more thin-walled with depth, 3–6 × 2–4 μm. *Algal layer* 50–90 μm deep; cells *Trentepohlia*-like, ellipsoid to globose, solitary or in short filaments, 10–23 × 10–16 μm. *Medulla* 20–40 μm deep; hyphae closely-set, 3–6 μm diam. *Perithecia* simple, entirely immersed in thalline verrucae, usually solitary, occasionally in pairs. *Verrucae* strongly convex to hemispherical, (0.38–)0.45(–0.56) mm diam., becoming somewhat attenuated at the base. *Ostiole* slightly depressed, somewhat darker than the surrounding tissue. *Centrum* globose, 0.2–0.25(–0.3) mm diam. *Excipulum* hyaline, 20–30 μm thick. *Periphyses* 20–30 × 1.5–2.5 μm, sparingly branched. *Paraphyses* simple, multicellular, persistent, 2 μm wide. *Asci* unitunicate, cylindrical or fusiform, thin-walled, containing 60–120 ascospores, 130–160 × 12–20 μm; apex tapering, rounded or somewhat flattened. *Hymenial gelatin* KOH/I+ pale blue. *Ascospores* colourless, 1-septate, broadly to elongate-ellipsoid, sometimes bent or with one cell larger than the other, frequently constricted at the septum, not obviously halonate, almost invariably bi-guttulate, (9.1–)12.2(–17.3) × (4.4–)5.4(–7.1) μm (40 individuals measured). (Fig. 1)

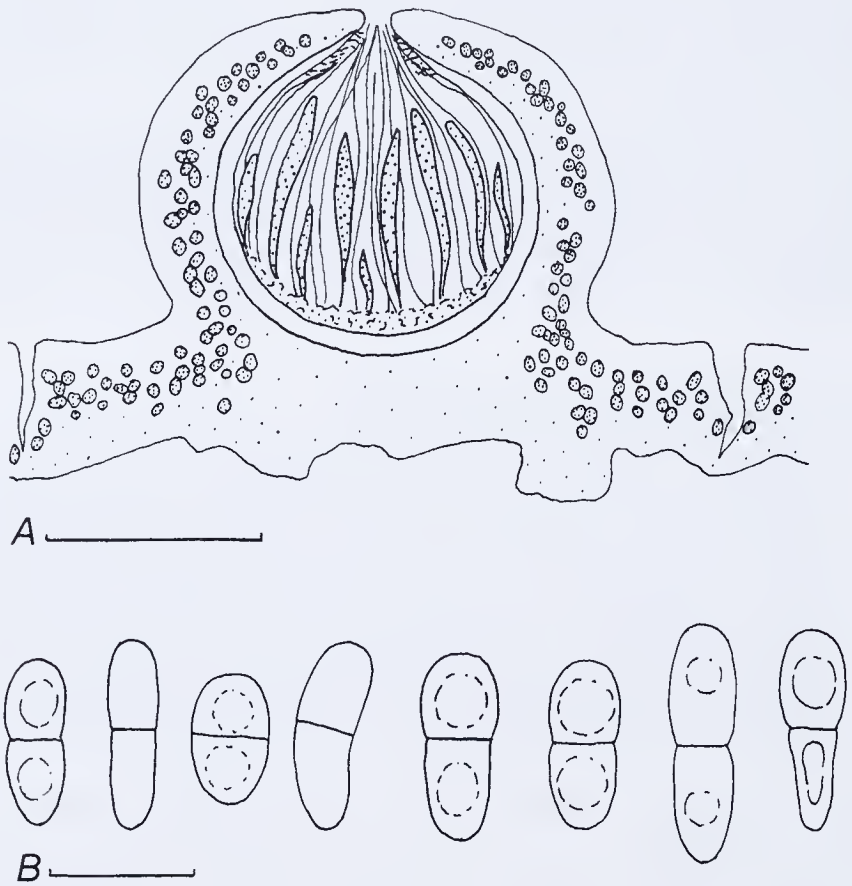

Fig. 1. *Thelopsis isiaca* var. *australis*. A — vertical section of perithecial verruca; scale 0.2 mm. B — ascospores; scale 10 μm.

DISCUSSION:

Thelopsis isiaca var. *australis* shares the salient features of var. *isiaca,* namely the thalline verrucae, immersed perithecia and 1-septate ascospores. It differs, however, in its siliceous substratum, its smooth areolate thallus, smaller asci (180–240 × 10–20 μm in the typus of var. *isiaca*) and in its smaller verrucae and perithecia.

According to Vězda (1968), *T. isiaca* possesses 0.4–0.5 mm diam. perithecia in verrucae that measure 0.6–1 mm. However, the holotype (H-NYL. 1436) and a second specimen from the type locality (Arnold, Lich. exs. 1635, in H-NYL.) together have mature verrucae measuring (0.46–)0.57(–0.74) mm (30 individuals). Moreover, the sole New World specimen of *T. isiaca*, first described as *T. subporinella* Nyl. *ex* Hasse, possesses verrucae of (0.45–)0.53(–0.62) mm (10 individuals). Thus, whereas recent gatherings have featured larger verrucae, those of the *typi* of *T. isiaca* and its synonym, though larger than those of var. *australis* are not discontinuous with them. Because of this, the new taxon is assigned varietal rather than a higher status.

ACKNOWLEDGEMENTS

I am grateful to the Director of the Botanical Museum, University of Helsinki for the loan of type material.

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NOTES ON AUSTRALIAN VERRUCARIACEAE (LICHENES): 2

by

P. M. McCarthy*

ABSTRACT

McCarthy, P. M. Notes on Australian Verrucariaceae (Lichenes): 2. *Muelleria* 7(3): 317-332 (1991). *Catapyrenium bullatescens* McCarthy, *Verrucaria australiensis* McCarthy, *V. hydrela* var. *puncticulata* McCarthy, *V. operculata* McCarthy, *V. subdiscreta* McCarthy and *V. tessellatuloidea* McCarthy are described as new from Australia. *Polyblastia cupularis* Massal., *Thelidium olivaceum* (Fr.) Körber, *V. dufourii* DC., *V. glaucina* Ach., *V. hydrela* Ach. and *V. striatula* Wahlenb. are reported for the first time from the continent. *Verrucaria halizoa* Leighton is the correct name for *V. cribbii* Rogers. A key to the marine and maritime Verrucariae presently known from Australia is provided.

INTRODUCTION

An examination of specimens housed in the major institutional herbaria in Australia and a more thorough survey of those collections in the National Herbarium of Victoria which might be expected to include Verrucariaceae indicates that the type genus is most diverse in the south-eastern states and in coastal areas of South Australia. This finding is not unexpected given the preference of *Verrucaria* for temperate and boreal environments in the Northern Hemisphere. Moreover, because the genus is also predominantly calcicolous, this combination of macroclimatic and substratum preferences should be helpful in locating those centres of greatest diversity in Australia.

Of the four marine and maritime Verrucariae included in the Third Edition of the 'Checklist of Australian Lichens' (Filson 1988), only two, *V. maura* Wahlenb. and *V. microsporoides* Nyl., have been reliably recorded. *Verrucaria ceuthocarpa* Wahlenb., reported by Müller (1893) from Warrnambool, Victoria, was stated to be "sine apotheciis"; its identity, therefore, must remain doubtful. Furthermore, Müller's report of *V. mucosa* Wahlenb. from Sandringham, Victoria bears the qualification "male evoluta" (Müller 1893); this material, in the National Herbarium of New South Wales, corresponds to *V. microsporoides* Nyl.

Recently, Rogers (1988) described *V. cribbii* from Heron Island, a tropical coral cay in Queensland. Intertidal Verrucariae have rarely been observed at such latitudes; they usually occupy a climatic gradient ranging from temperate to sub-polar. Whereas, *V. cribbii* occupies an unusual environment, in terms of its thalline and perithecial morphology it agrees with *V. halizoa* Leighton (syn. *V. microspora auct. angl. non* Nyl.).

The present contribution includes the descriptions of six new taxa together with new records of ten others, mainly from southern and south-eastern Australia. A key to the six marine and maritime species currently accepted for Australia is provided.

TAXONOMY

1. **Catapyrenium bullatescens** McCarthy, *sp. nov.*

Thallus squamulosus, terricolus, brunneus, 0.2–0.4(–0.5) mm crassus. *Squamulae* contiguae vel imbricatae, 1–2(–3) mm latae, rotundatae, elongatae vel irregulares, primum planae, deinde convexae vel bullatae, hebetatae, laevigatae vel rugulosae, saepe leviter rimulosae, ad marginem deflexae, integrae vel leviter lobatae, nunquam profunde incisae. *Stratum* epinecrale

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incoloratum, 7–15 μm crassum. *Cortex* bistratus, superior prosoplectenchymatus, inferior paraplectenchymatus, 40–60(–80) μm crassum. *Stratum* algarum (0.07–)0.1(–0.15) mm crassum; cellulae globosae, virides, 7–12(–14) μm diametro. *Medulla* 0.07–0.2 mm crassa; cellulae hypharum 8–15 × 4–6(–8) μm. *Cortex* infernus margine pallido-fuscus, interne fusco-ater, 20–30 μm crassus; cellulae hypharum rhizoidealium 15–30 × (4–)6(–8) μm. *Perithecia* simplices, immersa, plerumque solitaria, 0.35–0.5 mm diametro. *Apex* perithecii niger, planus vel leviter convexus, 0.25–0.38 mm diametro. *Ostiolum* inconspicuum vel leviter depressum. *Excipulum* praecipue incoloratum vel pallido-spadiceum, fuscans prope apicem, 26–36 μm crassum; cellulae 8–20 × 3–6 μm. *Centrum* globosum, 0.3–0.44 mm diametro. *Periphyses* 25–40 × 1.5–2 μm. *Paraphyses* evanescentes. *Asci* bitunicati, elongati-clavati, 8-spori, 90–120 × 10–15(–20) μm. *Gelatinum hymenii* J+ rubiginosum. *Ascosporae* simplices, incoloratae, elongatae vel latae-ellipsoideae, plerumque seriatae, guttulatae, (10.3–)12.8(–15.8) × (5.3–)6.3(–7.9) μm. *Conidiomata* 0.07–0.1 mm diametro, immersa, praecipue incolorata. *Conidia* bacilliformes, 2–3.5 × 0.7 μm.

HOLOTYPUS: Australia, New South Wales, Limestone Valley Creek, 9 km NE of Canowindra, 33°36′S, 148°41′E, alt. 460 m, "limestone outcrop in paddock with scattered *Brachychiton* and *Callitris*. On big branches of *Brachychiton*", 8.viii.1979, *H. Streimann 9253* (CBG 7911587).

Thallus squamulose, terricolous, brown, 0.2–0.4(–0.5) mm thick. *Squamules* contiguous to imbricate, 1–2(–3) mm wide, rounded, elongate or irregular, at first plane, becoming convex to bullate; surface matt, smooth to rugulose, frequently faintly rimulose; margin deflexed, entire to faintly lobate, never deeply incised. *Epinecral* layer colourless, 7–15 μm thick. *Cortex* bi-layered, 40–60(–80) μm thick; upper layer prosoplectenchymatous, with 1–2 rows of 10–15(–17) μm diam. cells that have 3–4(–5) μm thick pale brown walls; lower layer paraplectenchymatous, with 4–7 rows of angular and vertically elongated 9–15 × 6–9 μm cells that have 1.5–2.5(–3) μm thick colourless walls. *Algal layer* (0.07–)0.1(–0.15) mm thick; cells green, globose, 7–12(–14) μm diam. *Medulla* 0.07–0.2 mm thick; hyphal cells 8–15 × 4–6(–8) μm. *Lower cortex* pale brown near the margin, dark brown nearer the centre, 20–30 μm thick; cells 7–15 μm diam., producing a dense growth of rhizoidal hyphae with cells of 15–30 × (4–)6(–8) μm. *Perithecia* simple, immersed, usually solitary, 0.35–0.5 mm diam. *Perithecial* apex black, plane to slightly convex, 0.25–0.38 mm diam. *Ostiole* inconspicuous or located in a shallow depression. *Excipulum* colourless to pale yellowish-brown, except near the apex where it is pale to dark brown, 26–36 μm thick; cells 8–20 × 3–6 μm. *Centrum* globose, 0.30–0.44 mm diam. *Periphyses* 25–40 × 1.5–2 μm. *Paraphyses* evanescent. *Asci* bitunicate, elongate-clavate, 8–spored, 90–120 × 10–15(–20) μm. *Hymenial gel* I+ deep reddish-brown. *Ascospores* simple, colourless, elongate to broadly ellipsoid, usually uni-seriate in the asci, guttulate, (10.3–)12.8(–15.8) × (5.3–)6.3(–7.9) μm (50 individuals measured). *Conidiomata* 0.07–0.1 mm diam., laminal, immersed, with a hyaline wall and an apex that is concolorous with or slightly darker than the thallus. *Conidia* bacilliform, 2–3.5 × 0.7 μm. (Fig. 1)

DISCUSSION:

The type specimen of *Catapyrenium bullatescens,* though small, is abundantly fertile and its squamules exhibit a considerable breadth of form. However, its habitat requirements are, as yet, somewhat enigmatic. Thus, whereas the collector's notes suggest a corticolous existence, the squamules grow on a mildly calcareous 'soil' lacking all traces of bark cells. It is probable that the lichen inhabits a primitive soil accumulated in bark fissures and is, therefore, essentially terricolous.

Catapyrenium bullatescens possesses a distinctive combination of perithecial and vegetative attributes, namely, unusually large pale-walled ascomata immersed in small tightly packed and imbricate, convex to bullate squamules.

Four *Catapyrenia* are presently known from Australia. They include the cosmopolitan *C. lachneum* (Ach.) R. Sant. *s. lat.*, and *C. compactum* (Massal.) R.

Sant., a blackish squamulose-areolate species of limestone and calcareous lithosol in South Australia and Victoria. Two species, *C. bullatescens* and *C. cinereum* (Pers.) Körber, are known only from New South Wales. The latter, a common arctic-alpine species in the Northern Hemisphere, was collected at an altitude of 2000 m in the Snowy Mountains (McVean 1969); it is a pale grey to grey-brown lichen with minute pruinose squamules and brown-black perithecia.

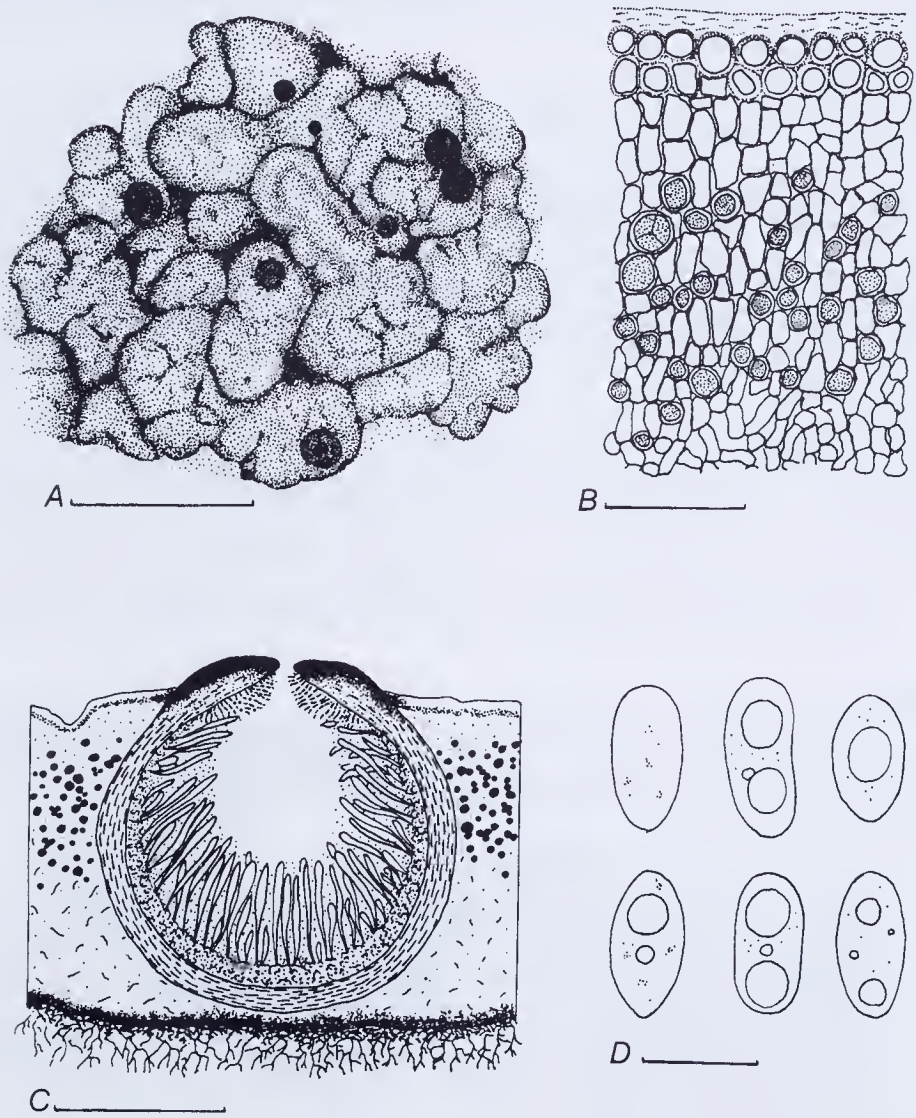

Fig. 1. *Catapyrenium bullatescens*. A — habit; scale 0.2 mm. B — vertical section of thallus showing epinecral layer, cortex and algal layer; scale 50 μm. C — vertical section of perithecium; scale 0.2 mm. D — ascospores; scale 10 μm.

2. **Polyblastia cupularis** Massal., *Ric. auton. lich. crost.*: 148 (1852).

The lichen genus *Polyblastia* is characterized within the Verrucariaceae by the muriform septation of its ascospores combined with the absence of hymenial algae. Such a definition is clearly unsatisfactory given the progressively elaborate ascospore septation that is continuous through both *Thelidium* and *Polyblastia*. The Victorian specimens of *P. cupularis* have a pale grey-brown subepilithic thallus and semi-immersed compound perithecia of 0.3–0.52 mm diam. The colourless ascospores measure 30–55 × 14–20 μm.

Previous reports of *Polyblastia* in Australia are referable to the unrelated and largely non-lichenized *Polyblastiopsis* Zahlbr.; the name *Polyblastia tichospora* (Knight) Shirley, listed by Filson (1988), is a synonym of *Polyblastiopsis tichospora* (Knight) Zahlbr.

SPECIMEN SEEN:

Victoria — Warrnambool, on mortar, ?.xi.1886, *F. R. M. Wilson 950* (NSW 219134, 219137).

3. **Thelidium olivaceum** (Fr.) Körber, *Parerga lichenol.*: 382 (1863).

Thelidium olivaceum is already known from central and southern Europe and the U.S.A. The Australian gathering has a minutely areolate olive-brown 20–50 μm thick thallus and numerous, semi-immersed to almost superficial, 0.18–0.26 mm wide perithecia. The latter, often partly overgrown by the thallus, have a thin involucrellum that is contiguous with the sides of the colourless excipulum. The ascospores are 1-septate, usually bi-guttulate and measure 19–25 × 9–12 μm.

SPECIMEN SEEN:

Victoria — Gippsland, Limestone Creek Scenic Reserve, 36°51′40″S, 148°03′20″E, on dry sheltered limestone, alt. 950 m, 29.xi.1989, *P.M. McCarthy 318* (MEL 1052307).

4. **Thelidium papulare** (Fr.) Arnold, *Flora, Jena* 68: 147 (1885).

Already reported from New South Wales (McCarthy 1990), this lichen is newly recorded from Victoria.

SPECIMENS SEEN:

Victoria — Gippsland, Buchan Reserve, 1 km NW of Buchan, end of track at camping ground, 37°29′35″S, 148°10′15″E, on dry sheltered limestone, alt. *c.* 75 m, 28.xi.1989, *P.M. McCarthy 241, 245* (MEL 1052308, 1052309); Gippsland, Limestone Creek Scenic Reserve, 36°51′40″S, 148°03′20″E, on dry sheltered limestone, alt. 950 m, 29.xi.1989, *P.M. McCarthy 319* (MEL 1052310).

5. **Verrucaria australiensis** McCarthy, *sp. nov.*

Thallus crustaceus, endolithicus et inconspicuus vel subepilithicus et effusus-farinosus, foveolatus, subcinereo-viridis. *Algae* virides, cellulis globosis, 5–8 μm diametro. *Cellulae* hypharum 5–8 × 3–5 μm. *Perithecia* simplicia, semiimmersa vel fere omnino immersa, plerumque solitaria, moderate numerosa, (0.1–)0.12(–0.14) mm diametro. *Apex perithecii* rotundatus vel subacutus, ater. *Centrum* globosum, (0.08–)0.09(–0.11) mm diametro. *Excipulum* lateraliter nigrum, basaliter fuscum, prope apicem 15–20 μm crassum, prope basem 12–15 μm crassum. *Periphyses* 14–17 × 2–3 μm. *Paraphyses* evanescentes. *Gelatinum hymenii* J+ rufum. *Asci* bitunicati, clavati vel cylindro-clavati, 8-spori, 30–45 × 12–16 μm. *Ascosporae* simplices, incolorate, ellipsoideae vel elongatae-ellipsoideae, (9.7–)11.7(–14.1) × (4.7–)5.8(–6.8) μm, contentis hyalinis, plerumque guttulatis.

HOLOTYPUS: South Australia, Eyre Peninsula, 17 miles S of Cowell, by the Lincoln Highway, on a limestone erratic, 23.x.1970, *R.B. Filson 11796* (MEL 117716).

Thallus crustose, endolithic and inconspicuous to sub-epilithic and effuse-farinose, pale grey-green. *Algae* green, globose, 5–8 μm diam. *Hyphal cells* 5–8 ×

3–5 μm. *Perithecia* simple, semi-immersed to almost completely immersed, usually solitary, moderately numerous, (0.1–)0.12(–0.14) mm diam, leaving pits in the rock following their decay. *Perithecial apex* rounded to somewhat pointed, black. Ostiole inconspicuous. *Centrum* globose, (0.08–)0.09(–0.11) mm diam. *Excipulum* black at the sides, brown at the base, 15–20 μm thick near the apex, 12–15 μm thick at the base; cells 6–8 × 3–4 μm. *Periphyses* 14–17 × 2–3 μm. *Paraphyses* evanescent. *Hymenial gel* I+ red-brown. *Asci* bitunicate, clavate to cylindro-clavate, 8-spored, 30–45 × 12–16 μm. *Ascospores* simple, colourless, ellipsoid to elongate-ellipsoid, (9.7–)11.7(–14.1) × (4.7–)5.8(–6.8) μm (40 individuals measured), usually guttulate; contents clear. (Fig. 2)

DISCUSSION:

Only *Verrucaria australiensis* and two other known species possess the combination of very small simple perithecia and minute ascospores. *Verrucaria simplex* McCarthy, from Great Britain, has perithecia similar to those of the Australian species; however, the thallus is dark brown and gelatinous-epilithic. In contrast, *V. lovcenensis* Servít, known from a single Yugoslavian collection, while having an endolithic habit, has larger perithecia and ascospores 8–11 μm wide.

6. **Verrucaria baldensis** Massal., *Ric. auton. lich. crost.*: 173 (1852).

This lichen is reported for the first time from Tasmania and the Australian Capital Territory.

SPECIMENS SEEN:

Tasmania — Bass Strait, Furneaux Group, Flinders Island *c.* 200 m W of Barclay's Sugarloaf, alt. 140 m, on limestone, 23.xii.1966, *J.S. Whinray* (MEL 28057; with *Xanthoria ligulata*); Kents Group, Deal Island, E of Brown's Bay, alt. 89 m, on limestone, 2.xii.1971, *J.S. Whinray* (MEL 1012594); Hogans Group, Hogan's Island, alt. 4–5 m, on a limestone outcrop, 27.xii.1973, *J.S. Whinray* (MEL 1012974).

Australian Capital Territory — Paddy's R., 17 km SW of Canberra, 35°20′S, 148°56′E, on exposed limestone outcrop in open woodland, alt. 500 m, 16.xii.1979, *H. Streimann 9759* (CBG 8000617).

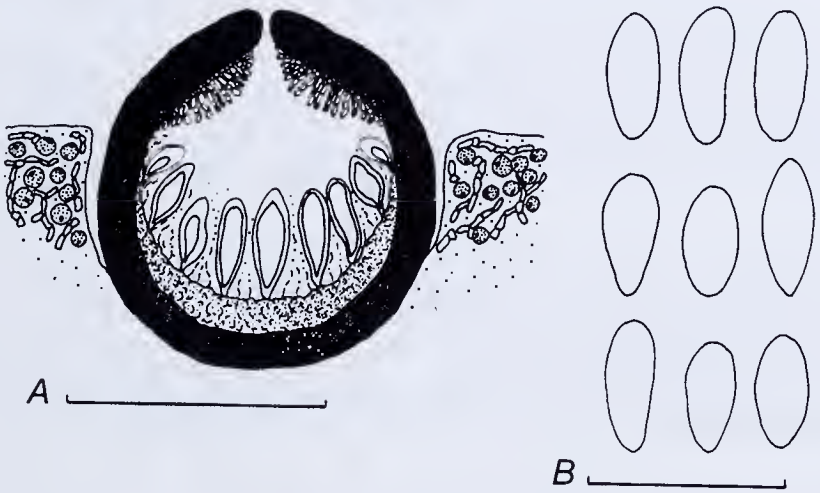

Fig. 2. *Verrucaria australiensis.* A — vertical section of perithecium; scale 0.1 mm. B — ascospores; scale 20 μm.

7. **Verrucaria dufourii** DC., *Flor. Franc.* 2: 318 (1805).

This is very much a cosmopolitan lichen of hard limestones in Eurasia; it is also known from North America. Previously unrecorded in the Southern Hemisphere, *Verrucaria dufourii* is one of the few species that can usually be identified on the basis of its macroscopic features alone. The perithecia of the Tasmanian specimen are semi-immersed, have a thick 0.3–0.4 mm diameter involucrellum and a flattened or excavate apex. The thallus is pale grey and subepilithic.

SPECIMEN SEEN:

Tasmania — Bass Strait, Kents Group, Deal Island, alt. 155 m, on a low limestone outcrop among tussock grass, 8.xii.1971, *J.S. Whinray* (MEL 1012601)

8. **Verrucaria glaucina** Ach., *Lich. univ.*: 675 (1810).

Verrucaria glaucina is a reasonably common calcicolous lichen in much of Eurasia; it is also known from the mid-western and western United States. The 5 mm wide thallus found on moderately shaded limestone in Gippsland, Victoria is grey-brown in colour, deeply rimose-areolate and is subtended by a black hypothallus; the walls of the angular 0.2–0.4 mm wide areolae are also black, but not the margins of the areolar plateaux. The perithecia have a diameter of 0.1–0.15 mm and an involucrellum that merges with the hypothallus. The ascospores measure 10–16 × 6–9 μm.

SPECIMEN SEEN:

Victoria — Gippsland, 500 m NNW of Buchan, The Bluff, 37°29′35″S, 148°10′15″E, on limestone, alt. 75 m, 28.xi.1989, *P.M. McCarthy 267* (MEL 1052311).

9. **Verrucaria hydrela** Ach., *Syn. Lich.*: 94, 339 (1814).

The CBG specimen of *V. hydrela,* collected and tentatively identified by D. Verdon, is the first record of this aquatic lichen from the Southern Hemisphere.

The thallus is very thin, continuous, gelatinous when wetted and dark green in colour. While most perithecia retain their characteristic thalline covering to maturity, some are quite bare. The spreading involucrellum has a diameter of 0.25–0.45 mm, the excipulum remains hyaline or pale brown and the ascospores measure 17–25(–27) × 7.5–10 μm.

Regarding the Victorian material, the Mount Cole specimens were gathered from margins of a fast-flowing mountain creek and have green to greenish-black thalli and perithecia of 0.25–0.5 mm; the ascospores measure 17–24 × 8–12 μm. In contrast, the East Gippsland material is somewhat problematical insofar as the ascospores, being 10–14 μm broad, approach those of *V. margacea* Wahlenb. However, in terms of their thalli and perithecia, their identity is not in doubt.

SPECIMENS SEEN:

Australian Capital Territory — Booth Range, Boboyan Road, Mt Clear camping ground, near junction of Grassy and Naas Creeks, 24 km SSW of Canberra, 35°53′S, 149°00′E, alt. 1100 m, on aquatic schistose rocks, 14.xi.1981, *D. Verdon 5036* (CBG 8113173).

Victoria — Western Region, Mt Cole State Forest, Sandy Creek, below waterfall, 1.5 km NE of Wareek Cemetary, 37°15′S, 143°12′E, alt. 560 m, on aquatic quartzite, granite and basalt, 9.x.1989, *P.M. McCarthy 39, 40* (MEL 1052312, 1052313); Gippsland, Limestone Creek Scenic Reserve, 36°51′40″S, 148°03′20″E, on inundated granite boulders at creek-edge, alt. 950 m, 29.xi.1989, *P.M. McCarthy* (MEL 1052314).

10. **Verrucaria hydrela** var. **puncticulata** McCarthy, *var. nov.*

Sicut var. *hydrela* sed thallus rimosus vel sparsim areolatus, viridi-niger vel cinereo-niger, 0.03–0.15 mm crassus, punctulis numerosis coalescentibus.

TYPUS: Australia, Victoria, Tyers area, White's Creek, 1 km upstream of its confluence with Tyers R., 38°06′20″S, 146°25′50″E, on inundated and submerged siltstone, alt. *c.* 120 m, 19.iv.1989, *P. M. McCarthy 5* (HOLOTYPUS: MEL 117709; ISOTYPUS: HO).

Thallus crustose, epilithic, rimose to sparingly areolate, green-black to grey-black, paler in deep shade, not gelatinous when wetted, 0.03–0.15 mm thick, forming 2–20 cm wide patches; surface smooth, more or less matt, with numerous circular or ellipsoid 20–40 μm wide black puncticulae that may coalesce to form sinuous 0.1–0.2 × 0.02–0.04 mm lines; the puncticulae become more numerous as the thallus ages. *Areolae* usually develop around perithecia, (0.3–)0.8(–1.2) mm wide, angular. *Cortex* prosoplectenchymatous, 6–9(–10) μm thick; cells thick-walled, 3–4(–5)m diam. *Algal layer* (20–)30–50(–60) μm deep; cells green, globose to ellipsoid, 4–7(–9) × 4–6 μm; interstitial hyphae thick-walled, 3–4(–5) μm diam. *Medulla* becoming carbonized; hyphae thick-walled, closely packed, 3–6 μm diam. *Prothallus* brown-black, visible as a basal layer, not extending beyond the margin. *Perithecia* compound, semi-immersed, numerous, usually solitary, often covered by a thin thalline layer almost to the apex. *Ostiole* sunken in a concavity 0.05–0.15 mm wide. *Involucrellum* (0.3–)0.5(–0.8) mm diam., contiguous with or arching away from the excipulum, dimidiate or extending to the excipulum-base level, black, 50–100 μm thick; the extent of penetration by the involucrellum is difficult to assess, since it merges with carbonized thalline hyphae. *Centrum* globose, (0.18–)0.25(–0.30) mm diam. *Excipulum* pale to dark brown, (10–)12–15(–18) μm thick; cells 6–12 × 3–5 μm. *Periphyses* 17–22 × 1–2 μm. *Paraphyses* evanescent. *Asci* bitunicate, 8-spored, clavate to cylindroclavate, 50–65 × 20–30 μm. *Hymenial gel* I–; ascoplasma I+, red. *Ascospores* simple, colourless, ellipsoid, ovate or, rarely, subglobose, (13.5–)16.6(–20.3) × (7.0–)9.2(–11.8) μm (52 individuals measured); contents coarsely granular. (Figs. 3, 4)

DISCUSSION:

Verrucaria hydrela var. *puncticulata* inhabits deeply shaded and very smooth rock surfaces in and beside of White's Creek. Although water levels in the creek were low when this lichen was first observed, it grew only on surfaces that were either submerged or continually splashed.

The new taxon may be distinguished from var. *hydrela* by the thicker puncticulate thallus that becomes progressively carbonised. Puncticulae may be seen even in the most recent marginal growth. They originate both internally and among hyphae close to the surface of the undifferentiated thallus (Fig. 4A). In time, they enlarge, coalesce and merge with the already blackened basal layer and with involucrella (Fig. 4B and C). Carbonization is most spectacular near perithecia where the photobiont occupies a thin discontinuous, almost vestigial, layer (Fig. 4D). It is only during this most extreme phase that the pigmented cortex is visible.

Carbonization and the upward growth of the thallus in the vicinity of perithecia may obscure the true extent of the involucrellum. Thus, in some instances, the perithecia appear to be embedded in thalline verrucae altogether lacking involucrella (Fig. 4E). However, the compound nature of the perithecia is usually unambiguous (Fig. 3, 4F).

11. **Verrucaria muralis** Ach., *Meth. Lich.*:115 (1803) — *V. rupestris* Schrader, *Spic. Fl. German.* 1: 109 (1794).

This lichen is reported for the first time from Tasmania.

SPECIMEN SEEN:

Tasmania — Bass Strait, Furneaux Group, Prime Seal Island, N of Northern Hill, alt. 50 m, on a limestone outcrop, 1.viii.1966, *J.S. Whinray* (MEL 1516752).

12. **Verrucaria nigrescens** Pers., *Ann. Bot. (Usteri)*: 14: 36 (1795).

This species is reported for the first time from New South Wales and the Australian Capital Territory.

SPECIMENS SEEN:

New South Wales — Limestone Valley Creek, 9 km NE of Canowindra, 33°36′S, 148°41′E, on a limestone outcrop, alt. 460 m, 8.viii.1979, *H. Streimann and B. Barnsley, HS9249* (CBG 7911853).

Australian Capital Territory — Paddy's R., 17 km SW of Canberra, 35°20′S, 148°56′E, on an exposed limestone outcrop, alt. 500 m, 16.xii.1979, *H. Streimann 9758* (CBG 8000613).

13. **Verrucaria operculata** McCarthy, *sp. nov.*

Thallus crustaceus, endolithicus, inconspicuus, foveolatus. *Algae* virides, cellulis globosis, 7–14 μm diametro. *Perithecia* composita, fere omnino immersa, numerosa, solitaria. *Involucrellum* atrum, (0.2–)0.3(–0.4) mm diametro, solum apicem versus excipulo conjunctato, planum vel moderate convexum, interdum 3–5 fissuris tenuibus radiantibus. *Ostiolum* saepe impressum, 20–40(–50) μm diametro. *Centrum* globosum vel obpyriforme, (0.23–)0.32(–0.42) mm diametro. *Excipulum* praecipue hyalinum, sed prope apicem fuscoatrum, 35–45 μm crassum. *Periphyses* 30–40 × 1.5–2.0 μm. *Paraphyses* evanescentes. *Asci* bitunicati, clavati, 8-spori. *Gelatinum* hymenii et ascoplasma J+ violaceus. *Ascosporae* incoloratae, simplices, latae vel elongatae-ellipsoideae, (20.0–)26.0(–32.0) × (9.4–)11.5(–14.7) μm, contentis subtiliter granulosis.

HOLOTYPUS: South Australia, Eyre Peninsula, 17 miles S of Cowell, by the Lincoln Highway, on limestone erratics lying on the sand, mostly in semi-shade, 23.x.1970, *R.B. Filson 11794* (MEL 1017961).

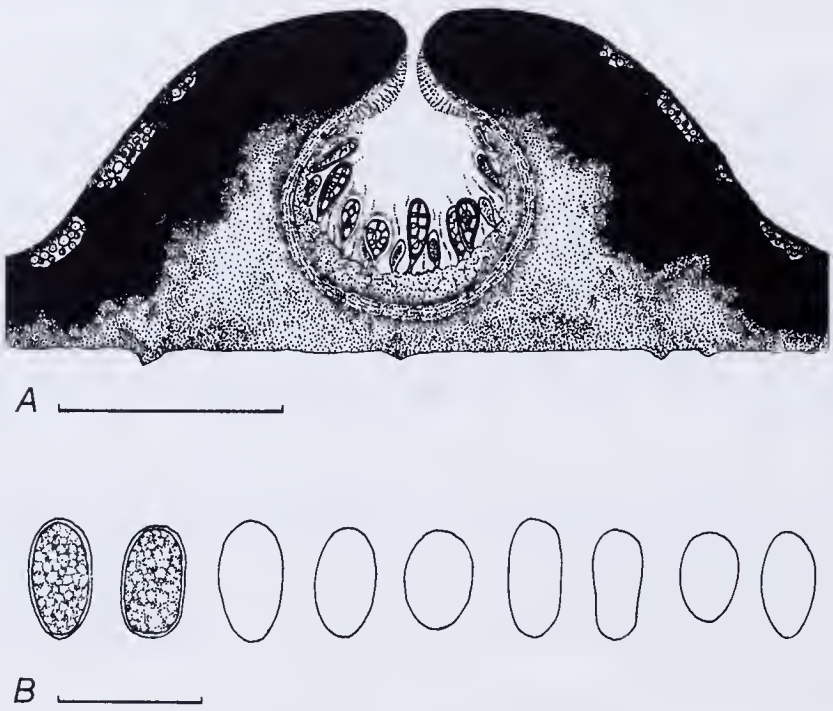

Fig. 3. *Verrucaria hydrela* var. *puncticulata*. A — vertical section of perithecium; scale 0.2 mm. B — ascospores; scale 20 μm.

Thallus crustose, endolithic, inconspicuous. *Algae* green, globose, 7–14 μm diam. *Hyphae* thick-walled, 3–4(–5) μm diam. *Perithecia* compound, almost completely immersed in the substratum, numerous, solitary, leaving pits in the limestone following their decay. *Involucrellum* black, (0.2–)0.3(–0.4) mm diam., joined to the excipulum only near the apex, extending laterally, then sharply downwards, occasionally with 3–5 fine fissures radiating from the ostiole, plane to slightly convex, but may become rounded and more prominent in older perithecia. *Ostiole* sunken or not, 25–40(–50) μm diam. *Centrum* globose to

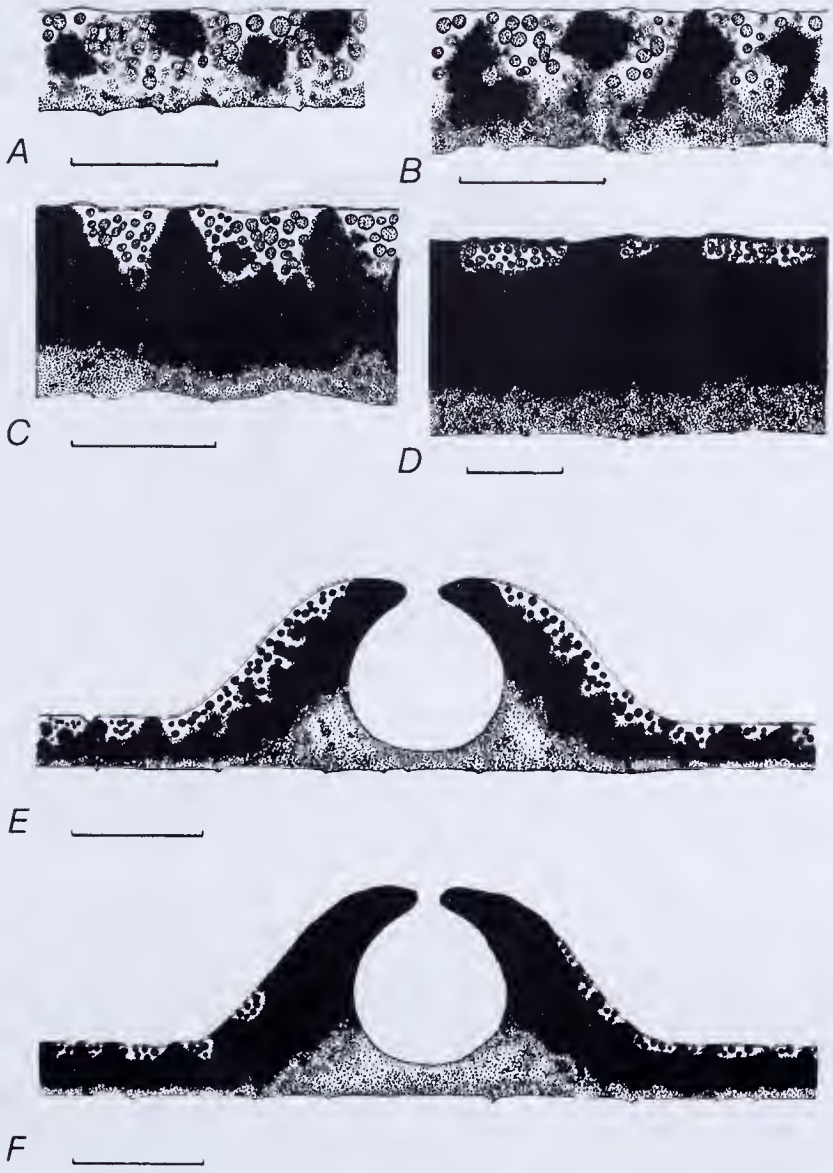

Fig. 4. *Verrucaria hydrela* var. *puncticulata*. A–D — gradual carbonization of the thallus; scales 50 μm. E, F — vertical sections of perithecia showing variable overgrowth by the thallus and development of the involucrellum; scales 0.2 mm.

obpyriform, (0.23–)0.32(–0.42) mm diam. *Excipulum* predominantly hyaline, but brown-black near the apex, 35–45 μm thick. *Periphyses* 30–40 × 1.5–2.0 μm. *Paraphyses* evanescent. *Asci* bitunicate, clavate, 8-spored. Numerous immature and empty asci were observed, but only one ripe individual (78 × 31 m). *Hymenial gel and ascoplasma* I+ violet. *Ascospores* colourless, simple, broadly to elongate-ellipsoid, (20.0–)26.0(–32.0) × (9.4–)11.5(–14.7) μm (50 individuals measured); contents finely granular. (Fig. 5)

DISCUSSION:

Verrucaria operculata belongs to the most clearly defined and apparently natural species-group within the genus. That this group should be recognised as the genus *Baglietoa* Massal. (syn. *Protobaglietoa* Servít) has received only sporadic support, most recently from Poelt and Vězda (1981). More general acceptance is unlikely prior to a thorough reassessment of generic relationships within the Verrucariaceae.

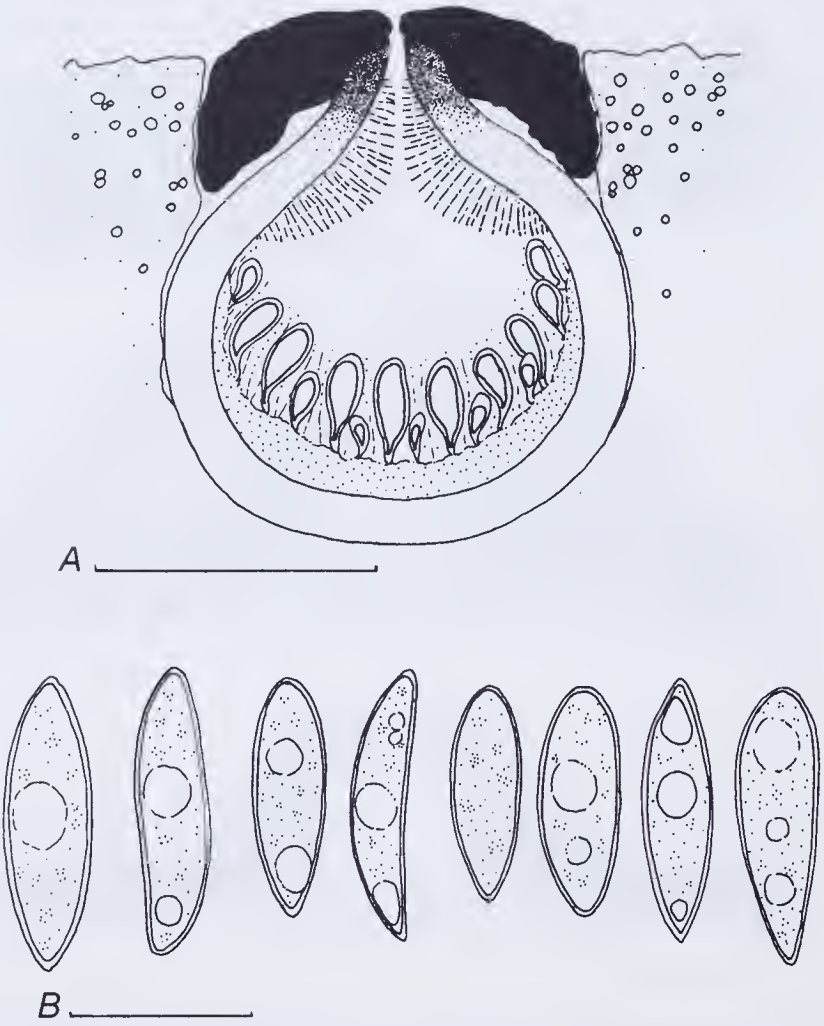

Fig. 5. *Verrucaria operculata*. A — vertical section of perithecium; scale 0.2 mm. B — ascospores; scale 20 μm.

The *Bagliettoa*-group, already represented in Australia by *V. baldensis* Massal., is characterised by an endolithic calcicolous thallus and perithecia with a lid-like involucrellum that is comparatively loosely-attached to the apex of the excipulum. Moreover, the involucrellum frequently exhibits a delicate radial fissuring.

Verrucaria operculata features unusually large perithecia and ascospores. The involucrellum surrounds an inconspicuous or sunken ostiole and, importantly, is appreciably narrower than the (0.3–)0.4(–0.5) mm diameter excipulum that is invariably hyaline or very pale brown. Similar ascospores are found in the southern European *V. limborioides* (Massal.) Clauzade & Roux. That lichen, however, possesses a prominent ostiolar protuberance on an involucrellum that is consistently broader than the excipulum. The latter has a diameter of 0.3–0.35 mm and ranges in colour from pale to dark brown (Clauzade & Roux 1985, Poelt & Vězda 1981).

OTHER SPECIMEN EXAMINED:

South Australia — Yudnapinna Station, on limestone, 26.vi.1965, *R.W. Rogers 32* (AD 20548).

14. **Verrucaria striatula** Wahlenb., in *Ach. Meth. Lich.*: 21 (1803).

Verrucaria striatula, a green subgelatinous lichen of the upper littoral zone on rocky seashores, is recorded from Australia for the first time. It is distinguished by a thallus from which develop glossy elongate and often branched carbonaceous ridges and by its 0.2–0.3 mm diameter perithecia with a dimidiate to sub-entire involucrellum that becomes flattened or markedly excavate at its apex. The ascospores measure 7–11 × 4–7 μm.

Whereas *V. striatula* is a common lichen on seashores in temperate and boreal regions of the Northern Hemisphere, Santesson (1939) described a new subspecies *australis* based on specimens from New Zealand. The latter displays a more effuse thallus margin, ridges with acute apices and more elongate algae than those of the palearctic subspecies. The specimens cited below correspond to *V. striatula* as it is known from European and North American coasts. Thus, the thallus margin ranges from determinate to effuse and only a minority of ridge-apices are acute; neither do the dimensions of the photobiont cells differ appreciably.

SPECIMENS SEEN:

Victoria — Warrnambool, supralittoral limestone, 16.viii.1949, *Bennett &* Pope (AD 20708); Mornington Peninsula, Blairgowrie, Cape Schanck Coastal Park, Spray Point, on calcareous sandstone in the upper littoral, 5.i.1990, *P.M. McCarthy 353* (MEL, HO, NSW, QLD).

Tasmania — Tasman Peninsula, Half Moon Bay, 40°44′S, 145°17′E, 6.xii.1961, *J.E.S. Townrow* (HO 65418); Bass Strait, Curtis Island, NW corner of island, 12.ii.1971, *R.B. Filson 12233* (MEL 40175).

15. **Verrucaria subdiscreta** McCarthy, *sp. nov.*

Thallus crustaceus, epilithicus, viridi-olivaceus vel viridi-ater, madefactus subgelatinosus, (20–)40–60 μm crassus, vulgo areolatus, punctulis atris minutis. *Areolae* angulares, regulares vel irregulares, plerumque planae, 0.1–0.25(–0.35) mm latae; substratum inter areolas plusminusve visibilis. *Algae* virides, plusminusve columnis verticalibus dispositae; cellulae latae ellipsoideae vel globosae, 4–8(–9) × 4–6 μm. *Perithecia* composita, semiimmersa vel fere superficialia, numerosa, plerumque solitaria. *Involucrellum* (0.12–)0.18(–0.22) mm diametro, nigrum, ad basim excipuli descendens, 30–40(–60) μm crassum. *Apex* perithecii plerumque rotundatus. *Centrum* globosum vel leviter obpyriforme, 0.08–0.15 mm diametro. *Excipulum* pallido-fuscum vel fuscoatrum, 10–15 μm crassum, cellulis 4–7 × 2–3 μm. *Periphyses* 10–18 × 1.5–2.5 μm. *Paraphyses* evanescentes. *Asci* bitunicati, clavati, 8-spori, 25–35 × 10–14 μm. *Gelatinum hymenii et ascoplasma* J–. *Ascosporae* simplices, incoloratae, ellipsoideae vel elongatae-ellipsoideae, (8.8–)11.5(–14.8) × (3.8–)5.0(–6.4) μm, contentis hyalinis vel subtiliter granulosis. *Conidiomata* numerosa, semiimmersa, 40–60(–80) μm diametro, ostiolo depresso. *Conidia* bacilliformes, 2–3 × 0.5 μm.

HOLOTYPUS: Australia, Tasmania, Hunters Island, Big Duck Bay, on quartzite, "on coast", 5.xi.1973, *T.B. Muir 5245* (MEL 1021253).

Thallus crustose, epilithic, olive-green to green-black (dull green in shade), subgelatinous and somewhat translucent when wetted, (20–)40–60 μm thick, may form colonies 3–5 cm wide, usually areolate, occasionally rimose, rarely effuse to continuous, dotted with carbonaceous puncticulae, 15–30 μm wide. *Areolae* angular, regular or irregular, deeply divided such that the substratum is faintly visible between areolae, matt, smooth, usually plane, occasionally slightly concave or convex, 0.1–0.25(–0.35) mm wide. *Algae* in more or less vertical columns, green; cells broadly ellipsoid to globose, 4–8(–9) × 4–6 μm. *Hyphae* 2–3 μm diam., thick-walled. The thallus is sometimes covered by a 3–7 μm deep hyaline amorphous layer subtended by a 6–8 μm deep brown-pigmented layer. *Perithecia* compound, semi-immersed to almost superficial, numerous, usually solitary, occasionally in groups of 2–3. *Involucrellum* 0.12–0.18(–0.22) mm diam., matt or glossy black, extending to exciple-base level, either contiguous with the excipulum or arching away from it, 30–40(–60) μm thick. *Apex* usually rounded. *Ostiole* inconspicuous to slightly depressed. *Excipulum* pale to dark brown, 10–15 μm thick; cells 4–7 × 2–3 μm. *Centrum* globose to somewhat obpyriform, 0.08–0.15 mm diam. *Periphyses* 10–18 × 1.5–2.5 μm. *Paraphyses* evanescent. *Asci* bitunicate, clavate, 8-spored, 25–35 × 10–14 μm. *Hymelial gel and ascoplasma* I–. *Ascospores* simple, colourless, ellipsoid to elongate-ellipsoid, (8.8–)11.5(–14.8) × (3.8–)5.0(–6.4) μm (60 individuals measured); contents clear to finely granular. *Conidiomata* numerous, semi-immersed, 40–60(–80) μm diam., with a black exposed surface that is depressed at the ostiole. *Conidia* bacilliform, 2–3 × 0.5 μm. (Fig. 6)

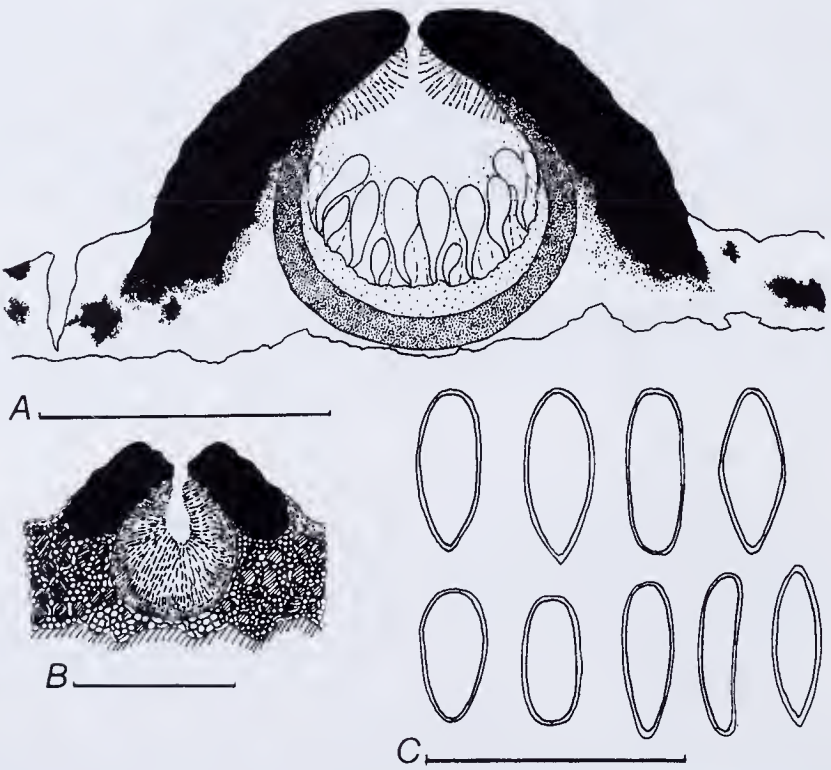

Fig. 6. *Verrucaria subdiscreta*. A — vertical section of perithecium; scale 0.1 mm. B — vertical section of conidioma and adjacent thallus; scale 50 μm. C — ascospores; scale 20 μm.

DISCUSSION:

The distinctiveness of *Verrucaria subdiscreta* lies in the combination of a thin areolate thallus, carbonaceous puncticulae, small prominent perithecia and small, rather than minute, ascospores. An inhabitant of a broad range of rock types at and above high water level, it is more maritime than marine. Thus, it occupies a niche not unlike that of the cosmopolitan *V. maura* Wahlenb. The latter, however, possesses a thicker thallus, perithecia of 0.25–0.5 mm diameter and ascospores of 12–20 × 6–10 μm. In terms of the perithecia and their contents, *V. subdiscreta* is closer to the lower to mid-littoral *V. halizoa* and *V. microsporoides*. However, the integrity of *V. subdiscreta* is supported both by ecological barriers and significant thalline differences. The Antarctic *V. dispartita* Vainio has a black scabrid non-puncticulate thallus on which are clustered 1–3 0.2–0.3 mm diam. semi-immersed perithecia (Lamb 1948); the latter are significantly larger than those of *V. subdiscreta*.

OTHER SPECIMENS EXAMINED:

Western Australia — Point Peron, limestone undercut in splash zone, 12.vii. 1970, *N. Sammy* (MEL 38521).

South Australia — Robe, 37°10′S, 139°45′E, on exposed supralittoral rocks, 17.viii.1953, *H.B.S. Womersley* (AD 20700); Kangaroo Island, Emu Bay, 35°35′S, 137°31′E, on supralittoral rocks, 26.i.1957, *H.B.S. Womersley* (AD 20533); Streaky Bay, *c.* 1.6 km NW of town, on supralittoral rocks, 10.ii.1954, *H.B.S. Womersley* (AD 20696); 24 km S of Port Lincoln, Whaler's Way Fence, SW of Fisheries Bay, on gneiss, "below H(igh) W(ater) M(ark)", 23.x.1970, *R.B.Filson 11811* (MEL 117722); Eyre Peninsula, 8 km W of Sheringa, "on cliffs at small beach, growing on limestone high above high water", 25.x.1970, *R.B. Filson 11885* (MEL 117711).

Victoria — Near Warrnambool, Hopkins Mouth, 22.viii.1986, *W.H. Ewers* (MEL 117713); Mornington Peninsula, Blairgowrie, Cape Schanck Coastal Park, Spray Point, on calcareous sandstone, at high water mark, 5.i.1990, *P.M. McCarthy* 352 (MEL).

Tasmania — Bass Strait, Furneaux Group, Babel Island, 45–90 m SE of the eastern end of the South-east Beach, 0.3–3 m above High Water, *c.* 45 m inland, on granite, 21.i.1967, *J.S. Whinray & M. Christie* (MEL 28066); Bass Strait, Flinders Island, The Bluff, 2.5 km NNW of Whitemark Village, alt. 0.3–0.9 m, on quartzite, 23.iv.1969, *J.S. Whinray* (MEL 1019456); Bass Strait, Kents Group, Erith Island, Bulli Bay sand beach, limestone outcrop 2.5–4.5 m in from HWL, alt. 1.8 m, 16.xii.1970, *J.S. Whinray* (MEL 1012874); Bass Strait, Curtis Island, gulch on NE side of the island, on granite,

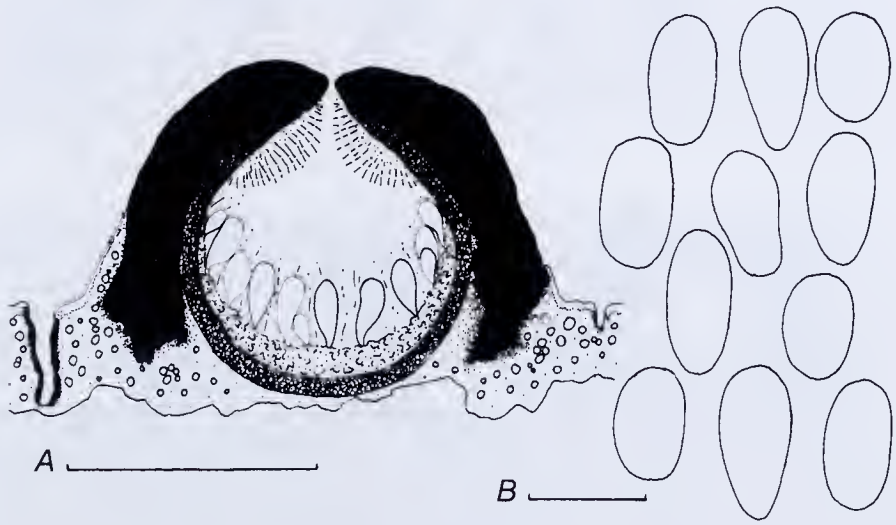

Fig. 7. *Verrucaria tessellatuloidea*. A — vertical section of perithecium; scale 0.2 mm. B — ascospores; scale 10 μm.

"growing at (high) water level and above...grades into *Caloplaca* zone and...along watercourses", 9.ii.1971, *R.B. Filson 12094* (MEL 40248); Curtis Island, around the northern cove and the hill above, on granite, "collected at sea level", 12.ii.1971, *R.B. Filson 12234* (MEL 40233); Cape Sorell, *c.* 42°12′S, 145°10′E, west-facing quartzite on the foreshore, ?.v.1971, *J.E.S. Townrow* (HO 39999).

Macquarie Island — Nuggets Point, alt. 40 feet, 18.iii.1964, *R.B. Filson 6355* (MEL 20418); Aurora Point, "loose scree fragments in long grass", alt. 70 feet, 7.xi.1965, *K. Simpson E92* (MEL 1000269); Bauer Bay, alt. 5–10 feet, 10.i.1972, *R. Hnatiuk 11710* (MEL 1027296).

16. **Verrucaria tessellatuloidea** McCarthy, *sp. nov.*

Thallus crustaceus, epilithicus, griseo-fuscus vel virido-fuscus, rimosus vel areolatus, 50–100(–150) μm crassus, laevis, hebetatus vel nitidus. *Areolae* angulares, planae vel leviter convexae, aliquando rimulosae, 0.2–1.0 mm latae; parietes rimarum denigrati. *Stratum* supremum non cellulosum, hyalinum vel subfuscum, 5–15 μm crassum. *Algae* virides, latae ellipsoideae vel globosae, 5–11 × 5–9 μm. *Hyphae* 3–4 μm diametro. *Perithecia* composita, 1/3–2/3 immersa, numerosa, plerumque solitaria. *Apex* perithecii rotundatus vel complanatus vel profunde concavum. *Ostiolum* fuscum, 30–100 μm latum. *Involucrellum* ad basim excipuli descendens, aliquando dimidiatum, nigrum, 0.22–0.35(–0.45) mm diametro, 50–75(–100) μm crassum. *Centrum* globosum, 0.12–0.20(–0.25) μm diametro. *Excipulum* lateraliter fuscum vel fusco-atrum, basaliter pallido-fuscum vel fusco-atrum, 18–25 μm crassum, cellulis 6–9 × 2–3 μm. *Periphyses* 25–45 × 1 μm. *Paraphyses* evanescentes. *Asci* bitunicati, clavati, 8-spori, 30–38 × 10–14 μm. *Gelatinum hymenii* J–; ascoplasma J+ rufum. *Ascosporae* simplices, incoloratae, ellipsoideae vel latae ellipsoideae, (7.9–)9.8(–11.8) × (4.7–)5.9(–6.8) μm, contentis hyalinis vel subtiliter granulosis.

HOLOTYPUS: Australia, Tasmania, Cape Bruny, 43°30′S, 147°09′E, on dolerite in sheltered crevices, 7.viii.1971, *G.C. Bratt 71/1089* (HO 39998).

Thallus crustose, epilithic, grey-brown to green-brown, rimose to areolate, 50–100(–150) μm thick; surface smooth, dull or glossy. *Areolae* angular, plane to slightly convex, occasionally rimulose, 0.2–1.0 mm wide; rimae with blackened walls. *Thallus* covered by a 5–15 μm thick hyaline to pale brown non-cellular layer. *Algae* green, broadly ellipsoid to globose, 5–11 × 5–9 μm. *Hyphae* thin-walled, 3–4 μm diam. *Perithecia* compound, 1/3–2/3 immersed, numerous, usually solitary. *Apex* rounded, almost plane or deeply concave. *Ostiole* brown, 30–100 μm wide. *Involucrellum* usually extending to excipulum-base level, occasionally dimidiate, black, 0.22–0.35(–0.45) mm diam., 50–75(–100) μm thick. *Centrum* globose, 0.12–0.20(–0.25) mm diam. *Excipulum* brown to brown-black at the sides, pale brown to brown-black at the base, 18–25 μm thick; cells 6–9 × 2–3 μm. *Periphyses* 25–45 × 1 μm. *Paraphyses* evanescent. *Asci* bitunicate, 8-spored, clavate, 30–38 × 10–14 μm. *Hymenial gel* I–; ascoplasma I+ red-brown. *Ascospores* simple, colourless, ellipsoid to broadly ellipsoid, (7.9–)9.8(–11.8) × (4.7–)5.9(–6.8) μm (60 individuals measured); contents clear to finely granular. (Fig. 8)

DISCUSSION:

That *V. tessellatuloidea* merits the designation 'maritime' is probable though not certain. Thus, the holotype is associated with, among others, several thalli of *Verrucaria aff. maura,* while the Cape Sorell specimen (below) adjoins some shaded thalli of *V. subdiscreta* as well as two *Caloplaca* spp. and a *Lecidea s. lat.* In spite of association with unequivocally maritime Verrucariae, the possibility exists that these collections represent the intrusion of a predominantly terrestrial lichen on to the seashore.

In terms of its habit, the new lichen bears resemblance to *V. tessellatula* Nyl., a supralittoral species known from islands in the South Atlantic and South Indian oceans as well as Tierra del Fuego (Redon 1985) and Macquarie Island. Both have a conspicuous grey-brown to green-brown areolate thallus. More importantly, they share an unusual feature, namely a blackening of the walls of thalline cracks in the absence of a blackened basal layer or prothallus. Unlike *V. tessellatuloidea,* however, Nylander's species possesses 0.15–0.20 mm diameter perithecia that are almost entirely immersed in the thallus. Moreover, the involucrellum is a thin

apical structure and the lateral and basal walls of excipulum are invariably colourless. The ascospores measure 11–15 × 6.5–9 μm (Lamb 1948).

OTHER SPECIMEN EXAMINED:

Tasmania — Cape Sorell, west facing quartzite on foreshore, ?.v.1971, *J.E.S. Townrow* (HO 39999).

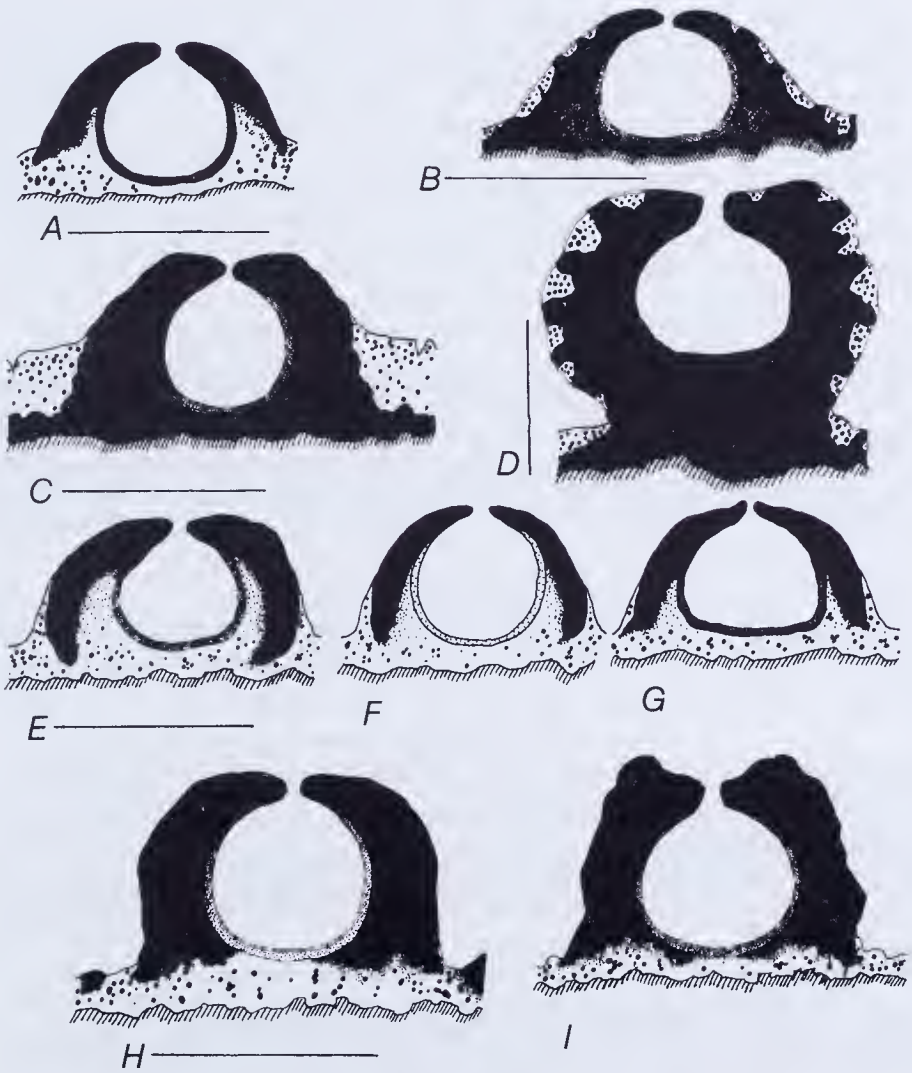

Fig. 8. Sectioned perithecia of some marine and maritime Verrucariae. A — *V. halizoa;* B–D — *V. maura;* E–G — *V. microsporoides;* H, I — *V. striatula.* Scales 0.2 mm.

KEY TO THE MARINE AND MARITIME SPECIES OF *VERRUCARIA* IN AUSTRALIA

1. Thallus with 0.05–0.1 mm wide glossy black often branched carbonaceous ridges, thin, green to green-black, gelatinous when wetted. Perithecia almost superficial, 0.2–0.3 mm diam.; involucrellum thick, apex becoming flattened or excavate; excipulum colourless to brown (Fig. 8H, I). Ascospores 7–11 × 4–7 μm. Mid-littoral to supralittoral, Vic., Tas. ..... *V. striatula*
1. Thallus without carbonaceous ridges 2

2. Thallus continuous to sparingly rimose; lower to mid-littoral species 3
2. Thallus richly rimose to areolate; upper littoral to supralittoral species 4

3. Ascospores 7.5–11 × 4.5–6 μm. Thallus thin, continuous, smooth, green to green-black, becoming gelatinous when wetted. Perithecia 1/3 immersed to almost superficial, 0.18–0.28 mm diam. (Fig. 8A). Lower littoral, Qld ..... *V. halizoa*
3. Ascospores 11–16(–18) × 4–6(–8) μm. Thallus thin, continuous to sparingly rimose, black. Perithecia semi-immersed to almost superficial, 0.15–0.3 mm diam. (Fig. 8E-G).
Lower to mid-littoral, W.A., N.S.W., Vic., Tas. ..... *V. microsporoides*

4. Ascospores 12–20 × 6–8 μm. Perithecia 0.25–0.5 mm diam., semi-immersed to almost superficial, partly overgrown by the thallus; excipulum colourless to brown-black (Fig. 8B-D). Thallus areolate, 0.1–0.7 mm thick, green-black to black, black-puncticulate, with a dark brown to black basal layer. Upper littoral to supralittoral, W.A., Vic., Tas. ..... *V. maura*
4. Ascospores 8–15 × 4–7 μm 5

5. Perithecia 0.12–0.22 mm diam. Thallus olive-green to green-black, black-puncticulate; areolae 0.1–0.35 mm wide. Ascospores 9–15 × 4–6.5 μm. Upper littoral to supralittoral, W.A., S.A., Vic., Tas. ..... *V. subdiscreta*
5. Perithecia 0.22–0.35(–0.45) mm diam. Thallus grey-brown to green-brown, lacking puncticulae; areolae 0.2–1.0 mm wide, with blackened sides. Ascospores 8–12 × 4.5–7 μm. Supralittoral, Tas. ..... *V. tessellatuloidea*

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NOTES ON THE LICHENIZED ASCOMYCETE GENUS *THELENELLA* Nyl. IN AUSTRALIA, SOUTHERN AFRICA AND ON THE ISLANDS OF THE SUBANTARCTIC AND ANTARCTIC

by

H. MAYRHOFER* AND P. M. MCCARTHY†

ABSTRACT

Mayrhofer, H. and McCarthy, P.M. Notes on the lichenized Ascomycete genus *Thelenella* Nyl. in Australia, Southern Africa and on the islands of the Subantarctic and Antarctic. *Muelleria* 7(3): 333–341 (1991) — The Australian, South African, Subantarctic and Antarctic records of the lichen genus *Thelenella* are summarized. *Thelenella tasmanica* Mayrh. & McCarthy is new to science. The new combination *Thelenella mawsonii* (Dodge) Mayrh. & McCarthy (syn. *Microglaena austrogeorgica* D.C. Lindsay) is made for a species closely related to *T. kerguelena* (Nyl.) Mayrh. *Thelenella luridella* (Nyl.) Mayrh. and *T. brasiliensis* (Müll. Arg.) Vainio are reported for the first time from Australia and South Africa, respectively. Additional records are given for *T. antarctica* (M. Lamb) Eriksson, *T. kerguelena, T. luridella*, and *T. mawsonii. Microglaena tibestiana* Werner is a new synonym of *T. luridella*. A revised key to the saxicolous species of *Thelenella* is provided.

INTRODUCTION

The lichen genus *Thelenella* was described by Nylander (1855) on the basis of a single species, *Verrucaria modesta*. Later, Zahlbruckner (1907, 1926) subsumed the genus within *Microglaena* Koerber, while more recently, Lindsay (1976b) provided a key to the Subantarctic and Antarctic *Microglaenae*.

According to Santesson (in Farr *et al.* 1979), *Microglaena* is a later homonym of *Microglena* Ehrenberg, an algal genus. Thus, in compliance with Articles 64 and 75 of the Code, it becomes illegitimate. Mayrhofer & Poelt (1985), in a revision of the European species of *Microglaena sensu* Zahlbr., recognised three genera, *viz. Chromatochlamys* Trevisan, *Protothelenella* Räsänen and *Thelenella* (syn. *Microglaena sensu stricto*) together with several discordant elements already detected by other workers (Vězda 1969, Santesson (in Hawksworth *et al.*) 1980, Jørgensen *et al.* 1983 and Jørgensen & Vězda 1984). In accordance with the suggestion of Eriksson (1981: 96), Mayrhofer (1987) described the new family Thelenellaceae, and although Harris (1989) aggreed with this move, he disputed the inclusion therein of *Chromatochlamys* and *Julella* H. Fabre. The latter, according to Barr (1986) belongs in the Arthopyreniaceae.

Thelenella is defined by a crustose thallus, often immersed perithecia, thick-walled bitunicate asci, a hamathecium of branched and anastomosing paraphyses and periphysoids, colourless to pale brown submuriform to muriform ascospores and conidiomata with filiform conidia; an open involucrellum is present in only a few species. It is noteworthy that most of the saxicolous species, with the exception of *T. brasiliensis* and *T. luridella*, appear to be restricted to maritime or at least oceanic habitats.

REVISED KEY TO THE SAXICOLOUS SPECIES OF *THELENELLA*

1. Ascospores more than 22 μm broad, 50–82 × 22–33 μm. Thallus thick, verrucose-areolate, sordid white to yellowish-white. Perithecia immersed. Antarctic islands ..... *T. antarctica*

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† National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

1. Ascospores less than 23 μm broad 2

2. Mature ascospores pale brown to brown, 30–45 × 15–22 μm. Thallus relatively thick, rimose-areolate to areolate, pale grey to grey-brown. Perithecia immersed. Juan Fernandez Island (SE Pacific Ocean) ..... *T. fernandeziana*
2. Mature ascospores colourless; over-mature ones may be pale brown 3

3. Perithecia possessing an involucrellum 4
3. Perithecia lacking an involucrellum 6

4. Ascospores ellipsoid to elongate-ellipsoid, 20–32 × 10–16 μm. Thallus thin, membranous to rimose. Perithecia semi-immersed to almost superficial. Subantarctic islands ..... *T. kerguelena*
4. Ascospores elongate-ellipsoid to subcylindrical, 34–52 × 13–20 μm 5

5. Thallus thick, matt, rimose-areolate, pale grey-brown to ochraceous. Involucrellum dark brown. Perithecia semi-immersed in thalline warts. Ascospores 35–47 × 14–19 μm. Guadalupe (Mexico) and San Nicholas Island (California) ..... *T. weberi*
5. Thallus very thin, smooth, effuse or determinate, continuous to sparingly rimose, pale greenish-grey. Involucrellum dark olive-brown to black (especially near the apex). Perithecia almost superficial. Ascospores 34–52 × 14–20 μm. Subantarctic islands ..... *T. mawsonii*

6. Ascospores 35–55 μm long 7
6. Ascospores 20–36 μm long 8

7. Perithecia with a hemispherical or conical apex, protruding from thalline warts. Thallus thin, sordid white to yellowish-green, rimose, smooth. Ascospores subcylindrical, 40–55 × 14–20 μm. Java ..... *T. marginata*
7. Perithecial apex not protruding from thalline warts. Thallus thin, ochraceous, yellowish-grey, grey or grey-brown, matt to slightly glossy, membranous-rimose to rimose-areolate. Ascospores ellipsoid to elongate-ellipsoid, 35–50 × 13–20 μm. Tropical and subtropical regions ..... *T. luridella*

8. Medulla I+ pale blue. Thallus thin, sordid white to yellowish-grey, continuous to rimose, smooth. Perithecia immersed to semi-immersed. Ascospores broadly ellipsoid, 22–27 × 10–14 μm. St Vincent Island (West Indies) ..... *T. elliottii*
8. Medulla I– 9

9. Ascospores broadly ellipsoid to ellipsoid, with 3–4 longitudinal divisions, 20–35 × 12–18.5 μm. Thallus rimose to areolate, pale to dark greenish-grey to grey-brown, glossy, smooth or uneven. Perithecia semi-immersed in thalline warts to almost superficial. Tasmania ..... *T. tasmanica*
9. Ascospores elongate-ellipsoid, oblong or subcylindrical, with 2–3 longitudinal divisions, 20–36 × 9–13 μm 10

10. Thallus thick, ochraceous to pale reddish-brown, rimose-areolate. Perithecia immersed in thalline warts. Ascospores elongate-ellipsoid to oblong, 24–36 × 9–13 μm. SW Europe, Canary Islands, California ..... *T. inductula*
10. Thallus thin, membranous to rimose, rarely rimose-areolate. Ascospores elongate-ellipsoid to subcylindrical 11

11. Thallus pale ochraceous to yellowish-brown, membranous-rimose, matt. Perithecia immersed. Ascospores 24–30 × 9–13 μm. Ellesmere Island (Arctic Canada), Disko Island (Greenland) ..... *T. sordidula*

11. Thallus pale brown, olive-brown or olive-green, membranous to membranous-rimose, matt to glossy. Perithecia immersed to semi-immersed. Ascospores 20–32 × 9–13 μm. Tropical and subtropical regions ..... *T. brasiliensis*

1. **Thelenella antarctica** (M. Lamb) Eriksson, *Opera Botanica* 60: 96 (1981) — *Microglaena antarctica* M. Lamb., *Discovery Reports* 25: 24 (1948).

This species is known from Deception, Desolation, Nelson and King George Islands in the South Shetland group (Lamb 1948, Guzman & Redon 1981) and also from the South Orkney Islands (Smith 1972, Redon 1985).

ADDITIONAL SPECIMENS EXAMINED:

South Shetland Islands — King George Island, Filder Peninsula, 6.ii.1983, *L. Kappen* (KIEL-HA).

South Orkney Islands — Livingston Island, South Beaches, Byers Peninsula, 7.xii.1965, *D.C. Lindsay 176* (AAS); Signey Island, NE side of Bernsten Point, Borge Bay, 21.xi.1966, *D.C. Lindsay 1396* (AAS); Signey Island, Bernsten Point, Borge Bay, 20.i.1967, *D.C. Lindsay 1513b, 1514a, 1523* (AAS).

2. **Thelenella brasiliensis** (Müll. Arg.) Vainio, *J. Bot.* 34: 293 (1896) — *Microglaena brasiliensis* Müll. Arg., *Flora, Jena* 71: 547 (1888).

This lichen was reported for the first time from Australia (SE Queensland) by Hafellner *et al.* (1989). The following is the first record from Southern Africa.

SPECIMEN SEEN:

Republic of South Africa — Cape Province, Humansdorp District, Blaauwkrantz Pass, on rocks in a ravine near the Bridge over Blaauwkrantz River, 23.viii.1953, *O. Almborn 3762* (LD).

3. **Thelenella harrisii** Mayrh., *Biblioth. Lichenol.* 26: 36 (1987).

This inconspicuous corticolous lichen, first described from California, U.S.A., is known from one locality in south-central New South Wales, Australia (Mayrhofer 1987).

4. **Thelenella kerguelena** (Nyl.) Mayrh., *Biblioth. Lichenol.* 26: 43 (1987) — *Microglaena kerguelena* (Nyl.) Zahlbr., *Deutsche Südpolar Exp., 1901–1903* 8: 51 (1906) — *M. austrocinerascens* D. Lindsay, *Nova Hedwigia* 27: 878 (1976).

This species has been reported from Kerguelen Island (Crombie 1876), Marion Island (Lindsay 1976a) and Heard Island (Dodge & Rudolph 1955; specimen not seen). The report from South Georgia (Mayrhofer 1987) refers to *T. mawsonii*.

5. **Thelenella luridella** (Nyl.) Mayrh., *Biblioth. Lichenol.* 26: 45 (1987) — *Microglaena luridella* (Nyl.) Zahlbr., *Cat. Lich. Univ.* 1: 192 (1921); for further synonyms, see Mayrhofer (1987).

NEW SYNONYM: *Microglaena tibestiana* Werner, *in* Maire & Monod, *Mem. Inst. Franc. Afrique Noire* 8: 18 (1950) — Lamb, *Ind. Nom. Lich.*: 416 (1963) — Mayrhofer, *Biblioth. Lichenol.* 26: 87 (1987). TYPUS: Algeria, Tibesti, Emi Koussi, Guelta de Karaie, alt. 2000 m, 12.ii.1940, *T. Monod 7781* (HOLOTYPUS: BC).

Mayrhofer (1987) reported *T. luridella* from the South Island of New Zealand and from the Transvaal, South Africa. Fully mature ascospores of re-examined and newly studied specimens are larger (35–50 × 13–20 μm) than previously cited (Mayrhofer 1987; 30–45 × 12–19 μm). An ascus with immature ascospores is seen in Fig. 4.

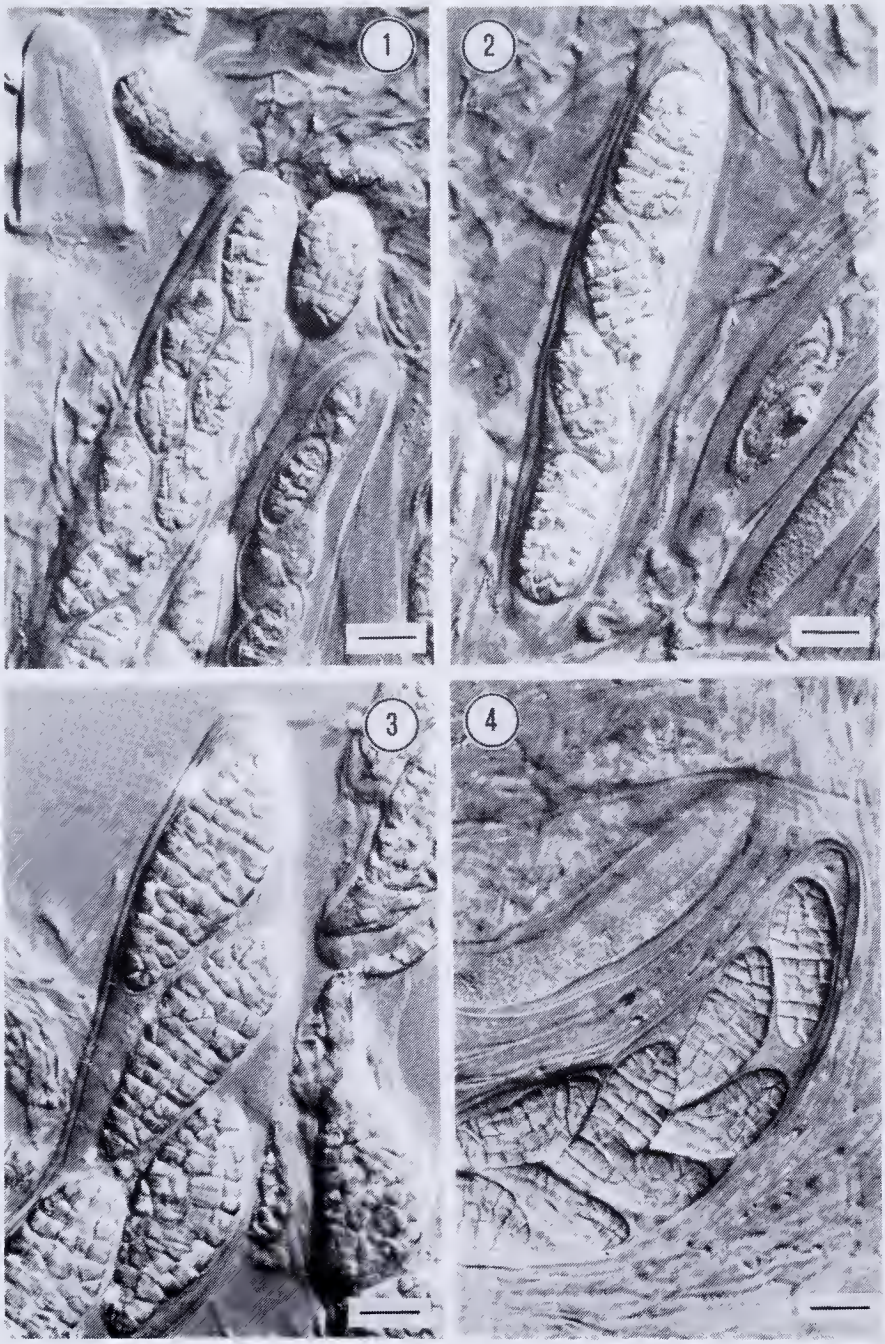

Fig. 1. *Thelenella tasmanica* (Holotypus). Asci with immature ascospores; scale 10 μm.

Fig. 2. *Thelenella tasmanica* (Holotypus). Ascus with mature ascospores; scale 10 μm.

Fig. 3. *Thelenella mawsonii* (Heard Island, MEL 1032266). Ascus with four mature ascospores; scale 10 μm.

Fig. 4. *Thelenella luridella* (Holotypus of *Microglaena tibestiana*). Ascus with immature ascospores; scale 10 μm.

ADDITIONAL SPECIMENS EXAMINED:

Australia — Queensland, Woodford Road, N of Dayboro, Terrors Creek, on greenstone boulders, alt. *c.* 300 m, 13.viii.1986, *J. Hafellner 15645 & G.N. Stevens* (Herb. Hafellner).

Southern Africa — Lesotho [Basutoland], Maseru Division, Roma Valley, 24.vi.1962, *L. Kofler* (LD).

6. **Thelenella mawsonii** (Dodge) Mayrh. & McCarthy, *comb. nov.*

BASIONYM: *Microglaena mawsonii* Dodge, *B.A.N.Z.A.R.E. 1929–1931 Rep., Ser. B,* 7: 46 (1948) — Lamb, *Ind. Nom. Lich.:* 416 (1963) — Lindsay, *Nova Hedwigia* 27: 879 (1976) — *Bull. Br. Antarct. Surv. Bull.* 44: 105 (1976) — Øvstedal, *Norsk Polarinstitutt Skr.* 185:50 (1986) — Mayrhofer, *Biblioth. Lichenol.* 26: 44 (1987). TYPUS: *Kerguelen Island,* Observatory Bay, above Port Jeanne d'Arc, alt. 1600 feet, 20.ii.1930, *B.A.N.Z.A.R.E. B 201* (HOLOTYPUS: FH; associated with *Steinera* sp., called *S. werthii* by Dodge (1948); according to Henssen & James (1982), it is *S. glaucella*).

SYNONYM: *Microglaena austrogeorgica* D. C. Lindsay, *Br. Antarct. Surv. Bull.* 44: 105 (1976) — Mayrhofer, *Biblioth. Lichenol.* 26: 44 (1987). TYPUS: *South Georgia,* Zenker Ridge, between Moraine Fjord and Hestesletten, alt. 25 m, 19.ii.1971, *R. I. L. Smith 1703* (HOLOTYPUS: AAS).

Thallus crustose, epilithic, pale greenish-grey, thin, effuse, continuous to sparingly rimose; surface matt, smooth. *Perithecia* numerous, usually solitary, almost superficial, with an open dark olive-brown to black (especially near the apex) involucrellum, 0.45–0.65 mm diam. *Ostiole* inconspicuous to excavate. *Excipulum* hyaline to pale brown at the base, becoming brown to dark brown at the sides, 25–35 μm thick. *Paraphyses* multicellular, branched and anastomosing, 0.8–1.2 μm thick. *Ascus* (4–)6(–8)-spored. *Ascospores* colourless, muriform, with 12–16 transverse and 3–4 longitudinal divisions, elongate-ellipsoid, 34–52 × 14–20 μm. *Conidiomata* not seen. (Figs. 3, 5)

Thelenella mawsonii is characterised by perithecia with a spreading involucrellum. Mayrhofer (1987) tentatively placed *Microglaena mawsonii* and *M. austrogeorgica* in the synonymy of the closely-related *T. kerguelena.* However, it is distinguished from *T. kerguelena* mainly by its larger ascospores.

DISTRIBUTION:

This lichen is known from Kerguelen, Heard and Macquarie Island, from South Georgia and from Bouvetøya (Øvstedal 1986, specimen not seen). It is represented in the MEL collections by 11 specimens from nine localities on Macquarie Island, where it has been found at altitudes ranging from 60 m to 370 m above sea-level. A selection of the latter is listed below.

ADDITIONAL SPECIMENS EXAMINED:

Kerguelen Island — Low Lands, 11.ii.1963, *R. B. Filson 4644* (MEL).

Heard Island — Atlas Cove, 8.ii.1963, *R. B. Filson 4584 & J. Williams* (MEL 1032266; associated with *Verrucaria maura*).

Macquarie Island — 1 mile N of Bauer Bay, 28.i.1964, *R. B. Filson 5827* (MEL); W of Brothers Summit, alt. 200 feet, 14.viii.1965, *K. Simpson E81* (MEL 1000416); peak of hill on the ridge N of and above Caroline Cove, alt. 800–900 feet, 20.i.1966, *K. Simpson E75* (MEL 1000267).

7. **Thelenella modesta** (Nyl.) Nyl., *Mem. Soc. Sci. Nat. Cherbourg* 3: 193 (1855) — *Microglaena modesta* (Nyl.) A. L. Sm., *Monogr. Brit. Lich.:* 308 (1911).

The report of this corticolous species from SE Queensland, Australia by Hafellner *et al.* (1989) was the first from the Southern Hemisphere. It has a scattered distribution in Europe and North America (Mayrhofer 1987).

8. **Thelenella tasmanica** Mayrh. & McCarthy, *sp. nov.*

Thallus epilithicus, pallidus vel atroviridigriseus vel griseobrunneus, 40–60(–100) μm crassus, rimosus vel areolatus. *Perithecia* simplicia, 0.4–0.6(–0.7) mm diametro, in verrucis thallinis semiimmersa vel fere superficialia. *Excipulum* ad basim hyalinum vel subfuscum, ad latera fuscescens, 25–35 μm crassum. Ascosporae 6–8, incolorate, muriformes, (20.6–)27.9(–35.3) × (11.8–)15.2(–18.5) μm. *Conidia* valde curvata, 10–16 × 0.7–0.9 μm.

TYPUS: Australia, Tasmania, Bass Strait, Furneaux Group, Isabella Reef, 32 m SE of summit, on maritime granite, alt. 6.5 m, 12.iii.1986, *J. S. Whinray 1707* (HOLOTYPUS: MEL 117717; ISOTYPUS: GZU).

Thallus crustose, epilithic, pale to dark greenish-grey to grey-brown, usually 1–2 cm diam., 40–60(–100) μm thick, rimose to areolate; surface usually glossy, smooth or uneven. *Areolae* 0.2–0.7(–1.0) mm wide, angular, regular or irregular

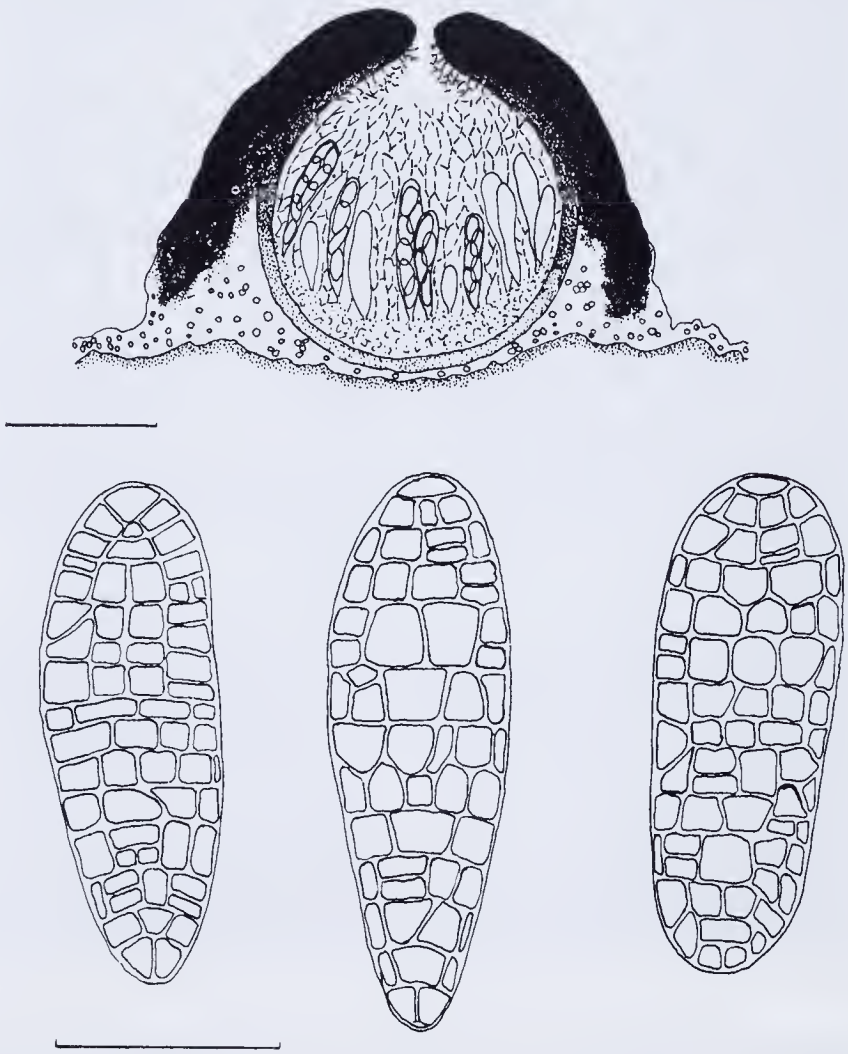

Fig. 5. *Thelenella mawsonii* (Heard Island, MEL 1032266). A — vertical section of perithecium and thallus; scale 0.2 mm. B — ascospores; scale 20 μm.

in shape, plane to somewhat convex, frequently rimulose. *Prothallus* often visible, dark olive-brown. The thallus is covered by a 15–25 μm thick colourless necral layer that is subtended by 1–2 layers of 3–5 μm diam brown-pigmented hyphal cells. *Algae* green, globose, 8–14(–16) μm diam; interstitial hyphae thick-walled, 2–3(–4) μm diam. *Perithecia* simple, 0.4–0.6(–0.7) mm diam., semi-immersed in thalline warts to almost superficial, often numerous, usually solitary, but occasionally in groups of 2–3. *Perithecial apex* grey-green to olive-brown to black, rounded, flattened or becoming concave. *Ostiole* inconspicuous or up to 0.1 mm diam. *Centrum* globose to transversely ellipsoid, 0.3–0.5(–0.55) mm wide. *Excipulum* hyaline to pale brown at the base, becoming brown to dark brown at the sides, 25–35 μm thick. *Paraphyses* and *periphysoids* multicellular, richly branched and anastomosing, 1.0–1.5 μm wide. *Periphyses* absent. *Asci*

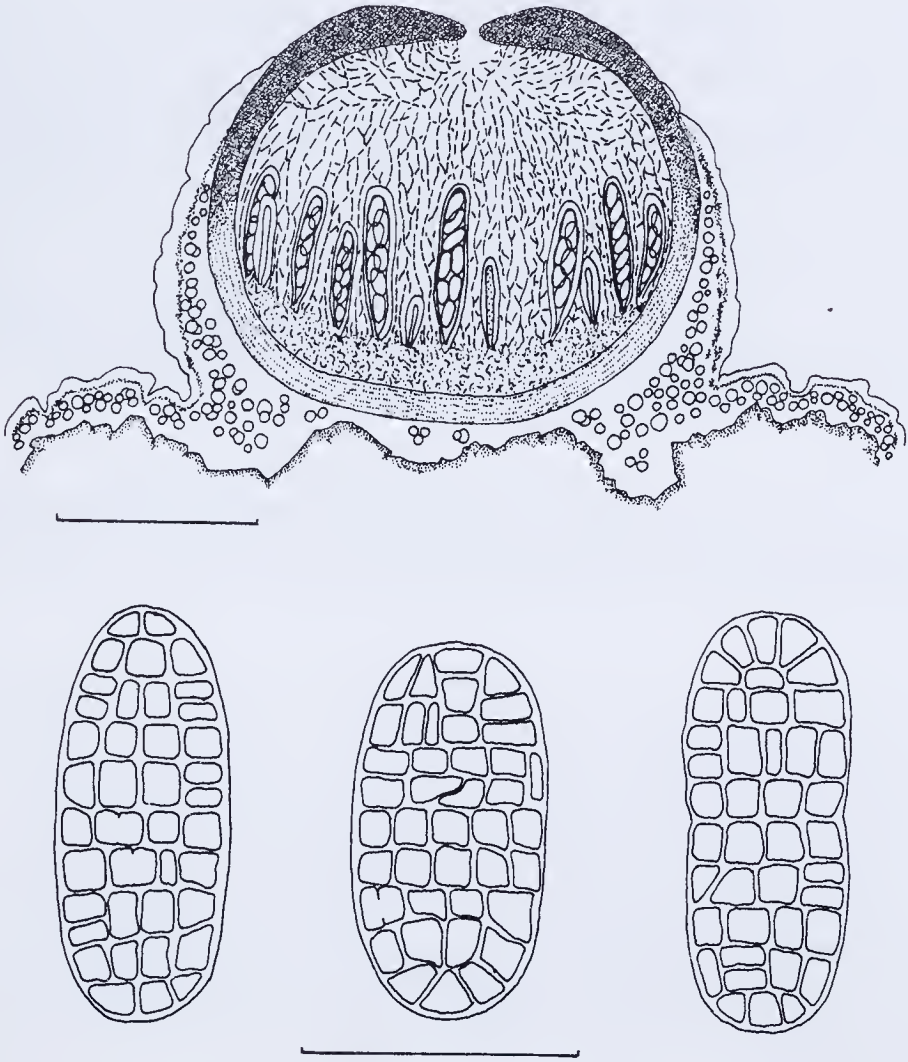

Fig. 6. *Thelenella tasmanica* (Holotypus). A — vertical section of perithecium and thallus; scale 0.2 mm. B — ascospores; scale 20 μm.

bitunicate, cylindro-clavate to cylindrical, thin-walled, 6–8-spored, I–, 100–140(–160) × 20–30 μm; apex rounded or flattened, without a visible apical apparatus. *Ascospores* colourless, muriform, with 7–11 transverse divisions and 3–4 longitudinal divisions, ellipsoid to broadly ellipsoid, usually uniseriate or biseriate in the asci, (20.6–)27.9(–35.3) × (11.8–)15.2(–18.5) μm (80 individuals measured). *Conidiomata* occasional, brown-walled, immersed, 0.08–0.12 mm diam. *Conidia* filiform, 10–16 × 0.7–0.9 μm, strongly curved. (Figs. 1, 2, 6)

Thelenella tasmanica is characterised by its rather thick areolate thallus, semi-immersed to almost superficial perithecia and broadly ellipsoid ascospores. The new species occurs mainly on maritime granite and is known from several islands in the Bass Strait and from a single locality on the north coast of mainland Tasmania.

ADDITIONAL SPECIMENS EXAMINED:

Tasmania (mainland) — Stanley Peninsula, North Point, on sea-worn basalt pebbles, alt. 3 m, 29.i.1965, *J.H. Willis* (MEL 7592; filed with *Lecanora ? sordida*).

Bass Strait Islands — Hunter Island, Big Duck Bay, on maritime quartzite, 5.xi.1973, *T.B. Muir 5252* (MEL 1021262; filed with *Rinodina teichophiloides*[1]); Curtis Island, ridge above NE peninsula, on exposed maritime granite, 9.ii.1971, *R.B. Filson 12113* (MEL 40289; filed with *Ochrolechia parella*); Furneaux Group, Little Green Island, on exposed maritime granite, 5–8 m in from high water level, alt. 2.5–3.5 m, 3.i.1975, *J.S. Whinray* (MEL 1019991); Furneaux Group, Passage Island, on maritime granite, 5–9 m in from high water level, alt. 1.5–3 m, 13.x.1979, *J.S. Whinray 1377* (MEL); Furneaux Group, Long Island, on exposed maritime granite, 1–3 m in from high water level, alt. 0.9–2.4 m, 1.i.1971, *J.S. Whinray & M.H. Christie* (MEL 1031727); Furneaux Group, Doughboy Island, on exposed maritime granite, alt. 0.5–0.75 m, 5.xi.1969, *J.S. Whinray* (MEL); Furneaux Group, Flinders Island, Killiecrankie Bay, on exposed maritime granite, 29.vii.1966, *J.S. Whinray* (MEL 1516785); Furneaux Group, Badger Island, Unicorn Point, on granite, 25 m in from high water level, alt. 5 m, 10.x.1975, *J.S. Whinray* (MEL 1019461); Kents Group, Deal Island, Browns Bay, on exposed maritime granite, 9–13 m in from high water level, alt. 1–2 m, 22.xii.1970, J.S. Whinray (MEL 1012507); Kents Group, North-east Island, on granite, 9 m in from high water level, alt. 4.5 m, 29.xi.1971, *J.S. Whinray (MEL* 1012610); Hogans Group, Hogans Island, on exposed maritime granite, alt. 4–5 m, 27.xii.1973, *J.S. Whinray* (MEL 1012985).

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[1] All records of *Rinodina subcrustacea* from the Bass Strait islands (Mayrhofer 1984) belong to *R. teichophiloides* (Stizenb.) Zahlbr. a maritime lichen described from the Cape of Good Hope and also known from coastal areas of the Tasmanian mainland, New Zealand and Tierra del Fuego.

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SOME PYRENOCARPOUS LICHENS FROM MACQUARIE ISLAND

by

P. M. McCarthy*

ABSTRACT

McCarthy, P.M. Some pyrenocarpus lichens from Macquarie Island. *Muelleria* 7(3): 343–347 (1991). — Five saxicolous pyrenocarpous lichens are reported from Macquarie Island. *Verrucaria bubalina* McCarthy *sp. nov.* is described.

INTRODUCTION

Macquarie Island is situated in the Southern Ocean between New Zealand and Antarctica. Until comparatively recently little published information concerning its lichen flora had been made available. Small collections made during the British, Australian and New Zealand Antarctic Research Expedition (B.A.N.Z.A.R.E.) of 1929–1931 and in the decade following the establishment of the Australian National Antarctic Research Expedition station in 1948 were sent to C. W. Dodge who described 25 new taxa (Dodge 1948, 1968, 1970, Dodge & Rudolph 1955).

The period 1963–1972 saw a more intensive investigation of the lichen flora, mainly through the efforts of R. B. Filson, K. S. Simpson, R. J. Hnatiuk and R. Waterhouse (Filson 1981). Subsequently, Filson provided accounts of some of the more important macrolichen genera on the island (Filson 1981a, 1986, Filson & Archer 1986). The National Herbarium of Victoria houses the bulk of these later collections.

Little is known of the pyrenocarp flora of Macquarie Island. Dodge's papers includes 5 newly described taxa, *viz. Arthopyrenia macquariensis, Mastodea macquariensis, Microthelia macquariensis, Phyllopyrenia macquariensis* and *Porina macquariensis*. The maritime lichen *Verrucaria subdiscreta* McCarthy has since been observed among the MEL collections (McCarthy 1991), as has *Thelenella mawsonii* Mayrh. & McCarthy (Mayrhofer & McCarthy 1991).

Pyrenocarpous lichens are well represented among the Macquarie Island collections in MEL. Five taxa, all of which are reported from Macquarie Island for the first time, are enumerated below. Further Verrucariae await identification as do at least four species of *Porina* Müll. Arg.

TAXONOMY

1. **Thelidium praevalescens** (Nyl.) Zahlbr., *Deutsche Sudpolar Exp., 1901–1903* 8: 51 (1906) — *Verrucaria praevalescens* Nyl. *in* Crombie, *J. Linn. Soc., Bot.* 15: 192 (1876).

The silicolous *Thelidium praevalescens* was first collected on Kerguelen Island in the South Indian Ocean and has since been found on nearby Heard Island (Dodge 1948). The thalli of the Macquarie Island specimens are pale yellow-brown to olive brown, rimose to sparingly areolate and up to 0.1 mm in thickness. Most perithecia are semi-immersed in the thallus and have a thick 0.3–0.6 mm diameter involucrellum that is often almost entirely covered by the thallus. The colourless 3-septate spores measure 35–55 × 14–22 μm.

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SPECIMENS EXAMINED:

Macquarie Island — half way along E shore of Lake Flynn, on gabbro, alt. 180 m, 3.ii.1964, *R.B. Filson 5895, 5896 & J. Phillips* (MEL); south shore of Lake Flynn, on gabbro, 3.ii.1964, *R.B. Filson (5901) & J. Phillips* (MEL).

2. **Verrucaria bubalina** McCarthy, *sp. nov.*

Thallus crustaceus, epilithicus, praecipue bubalinus, aliter subgriseo-fuscum vel griseo-viridis, hebetatus, laevigatus, rimosus, 0.05–0.15(–0.3) mm crassus, strato basali fusco vel fuscoatro, saepe discontinuo, 0.02–0.06(–0.15) mm crasso; margo diffusus, pallido-bubalinus; thallus tectus ab strato necrali hyalino, 5–15 μm crasso. *Cortex* fuscus, male limitatus, 5–10 μm crassus. *Stratum algarum* diffusum, 0.5–0.1 mm crassum; cellulae virides, latae-ellipsoideae vel globosae, 5–11 × 5–9 μm. *Hyphae* arcte contiguae, parietibus tenuibus, 3–5 μm diametro. *Perithecia* atra vel fusco-atra, composita, semiimmersa vel fere omnino immersa, numerosa, plerumque solitaria. *Ostiolum* inconspicuum vel leviter depressum, plerumque griseo-fuscum. *Involucrellum* apicale vel dimidiatum vel subintegrum, cum excipulo contiguum, 0.25–0.5 mm diametro, 0.06–0.08(–0.12) mm crassum, extra aliquando laevigatum, plerumque cum 12–20 jugis carbonaceis, inconspicuis vel prominantibus, ex ostiolo radiatis. *Apex ascomatis* plerumque moderate complanatus. *Centrum* globosum, 0.2–0.35 mm diametro. *Excipulum* fuscum vel fusco-atrum, 20–35 μm crassum. *Periphyses* 30–40 × 1.5–2 μm. *Paraphyses* evanescentes. *Asci* bitunicati, clavati, 8-spori, 55–67 × 18–25 μm. *Gelatinum hymenii* J+ vinaceum. *Ascosporae* simplices, incoloratae, longae-ellipsoideae, (14.7–)18.9(–23.5) × (6.8–)8.8(–11.2) μm, contento subtiliter granuloso.

HOLOTYPUS: Macquarie Island, Hasselborough Bay beach, on basalt "in an exposed situation", 10.iv.1972, *R. Waterhouse A59* (MEL 1020945).

Thallus crustose, epilithic, usually buff-brown, otherwise grey-brown or grey-green, matt, smooth, rimose, 0.05–0.15(–0.3) mm thick, with a brown to brown-black, 0.02–0.06(–0.15) mm thick basal layer that is often discontinuous; margin diffuse; the thallus is covered by a hyaline necral layer, 5–15 μm thick. *Cortex* brown, poorly-defined, 5–10 μm thick. *Algal layer* diffuse, 0.5–0.1 mm thick; cells broadly-ellipsoid to globose, 5–11 × 5–9 μm. *Hyphae* densely-packed, thin-walled, 3–5 μm diam. *Perithecia* compound, semi-immersed to almost entirely immersed, numerous, mostly solitary. *Ostiole* inconspicuous or slightly depressed. *Involucrellum* ranging from a thickening about the uppermost third of the perithecium, to dimidiate, to almost subentire, contiguous with the excipulum, 0.25–0.5 mm diam., 0.06–0.08(–0.12) mm thick, externally occasionally smooth or with 12–20 faint to pronounced carbonaceous ridges radiating from the ostiole. The perithecial apex is usually somewhat flattened, frequently grey-brown around the ostiole. *Centrum* globose, 0.2–0.35 mm diam. *Excipulum* brown to brown-black, 20–35 μm thick. *Periphyses* 30–40 × 1.5–2 μm. *Paraphyses* evanescent. *Asci* bitunicate, clavate, 8-spored, 55–67 × 18–25 μm. *Hymenial gel* and ascoplasma I+ deep wine-red. *Ascospores* (14.7–)18.9(–23.5) × (6.8–)8.8(–11.2) μm (70 individuals measured); contents finely granular. (Fig. 1)

DISCUSSION:

Verrucaria bubalina is a maritime lichen of hard siliceous rocks. The three specimens were found at altitudes ranging from sea-level to almost 200 m; they were associated with *Verrucaria maura, V. durietzii, Pertusaria* sp., an indeterminate moss and a species of the green alga *Prasiola.*

Morphological variability among the specimens examined is most clearly seen in the surface features, thickness and downward penetration of the involucrellum and in the thickness of the hypothallus. The surface of the involucrellum ranges from a dull dark brown to glossy black, from smooth to radially ridged (Fig. 2A, B). In vertical section its penetration is seen to reflect the degree of immersion of the perithecium. The hypothallus rarely develops as a distinct layer within several millimetres of the thallus margin; under older areolae, its thickness and degree of carbonisation may vary dramatically, even between adjacent areolae.

Verrucaria bubalina is distinguishable from other buff-brown epilithic Verrucariae in the supralittoral of the Antarctic and Subantarctic regions by its

thallus, its moderately large perithecia with a dark excipulum and by the dimensions of its ascospores. Thus, *V. durietzii* Lamb has a lobate thallus margin, a persistently thicker hypothallus, smaller perithecia and smaller ascospores; *Verrucaria tessellatula* Nyl. has black-walled rimae and very much smaller perithecia and ascospores; *V. elaeoplaca* Vainio possesses a verrucose-areolate thallus and smaller perithecia with a colourless excipulum. Two species from Kerguelen Island deserve mention:

V. mawsonii Dodge features larger perithecia, a colourless excipulum, ascospores of 15–18 μm in length and a black-puncticulate thallus (Dodge 1948); *V. werthii* Dodge has a thin tartareous thallus, superficial perithecia and ascospores of 12–15 × 7–8 μm (Dodge 1948).

OTHER SPECIMENS EXAMINED:

Macquarie Island — Lusitania Bay, "rocky (basalt) outcrop on (the) beach", 10.ii.1964, *R.B. Filson (5976) & P. Atkinson* (MEL); Caroline Cove, on basalt, centre of penguin colony, alt. 600 feet, *K. Simpson E53* (MEL 1000277).

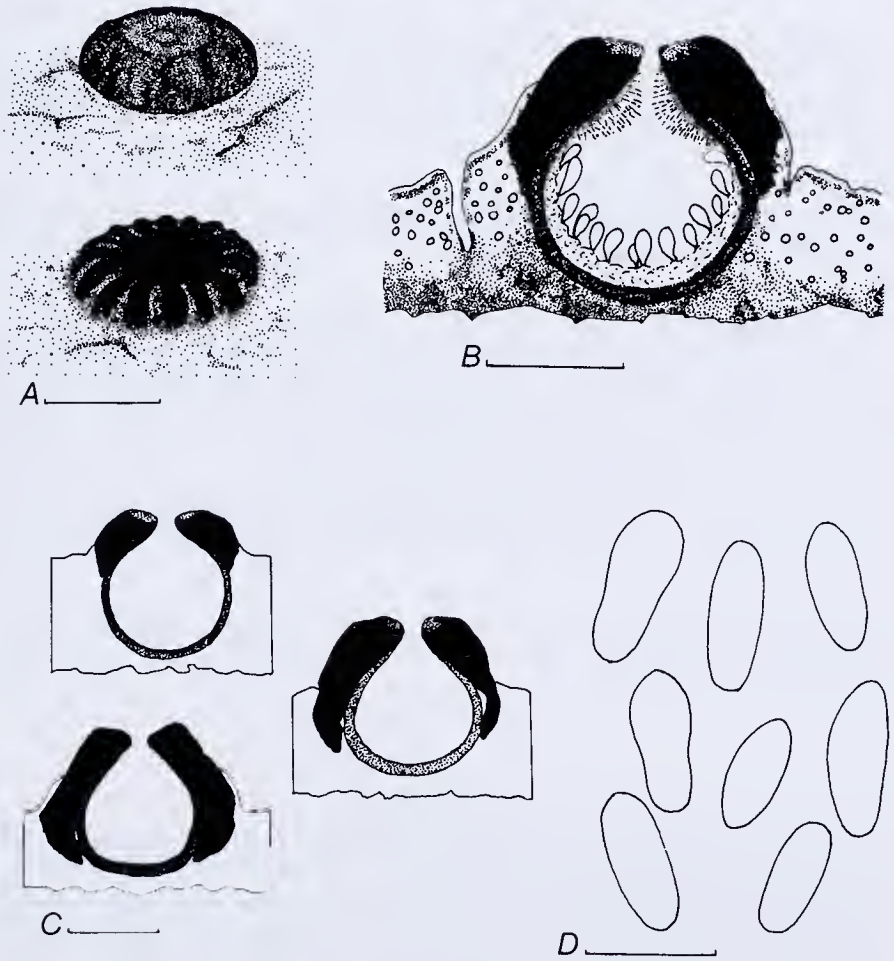

Fig. 1. *Verrucaria bubalina*. A — oblique views of perithecial apices showing smooth and radially ribbed forms; scale 0.2 mm. B — vertical section of perithecium and thallus; scale 0.2 mm. C — vertical sections of perithecia exhibiting variously developed involucrella; scale 0.2 mm. D — ascospores; scale 20 μm.

3. **Verrucaria durietzii** Lamb, *Lilloa* 14: 205 (1948).

Verrucaria durietzii is one of the most distinctive members of a complex and complicated genus. The pale buff-brown to dark brown thallus together with its exceptionally well-developed carbonaceous hypothallus may be up to 2 mm thick. Forming large continuous colonies, it is distinctly lobate at the margin and deeply areolate nearer the centre. The black 0.15–0.3 mm wide perithecia are semi-immersed to almost entirely immersed and have a generally poorly-developed apical to dimidiate involucrellum. The ascospores are 12–17 × 7–11 μm.

This maritime silicolous lichen is already known from New Zealand and the Auckland Islands (Lamb 1948). Twenty-one Macquarie Island specimens have been seen; they were collected at 13 localities at altitudes of up to almost 200 m.

SELECTED SPECIMENS EXAMINED:

Macquarie Island — below summit of Brothers Point, on basalt "at water's edge", 14.viii.1965, *K. Simpson A72* (MEL 1000413); Caroline Cove, on rock in centre of penguin colony, alt. 600 feet, 18.i.1966, *K. Simpson E52* (MEL 1000284); Upper Nuggets Valley, on rock, 30–50 feet above sea-level, 21.i.1972, *R. Hnatiuk 11800* (MEL 1027297).

4. **Verrucaria maura** Wahlenb., *in* Ach., *Meth. Lich.*: 19 (1803).

This cosmopolitan species of the upper littoral and supralittoral on rocky seashores is represented in 31 collections at MEL. It was found at 16 localities at up to 15 m above sea-level.

SELECTED SPECIMENS EXAMINED:

Macquarie Island — 1/2 mile S of Douglas Pt, alt. 6 feet, 9.xi.1966, *K. Simpson E24* (MEL 100419); The Brothers, alt. 10–20 feet, 8.i.1972, *R. Hnatiuk 11696* (MEL 1027206); W of Aurora Cave, 21.i.1972, *R. Hnatiuk 11810* (MEL 1027273).

5. **Verrucaria tessellatula** Nyl., *in* Crombie, *J. Bot., Lond.* 13: 335 (1875).

First collected on Kerguelen Island in 1874–75 by E. A. Eaton during the Transit of Venus Expedition, *V. tessellatula* has since been seen on Tierra del Fuego, the Falkland Islands (islas Malvinas), South Georgia and on the South Shetland and South Orkney Groups (Redon 1985). Two Macquarie Island specimens of this supralittoral lichen have been seen.

Verrucaria tessellatula has a pale buff-brown rimose to areolate thallus with black-walled rimae. The immersed 0.1–0.2 mm diam. perithecia have a black apical involucrellum, a colourless excipulum and ascospores of 10–15 × 7–9 μm.

SPECIMENS EXAMINED:

Macquarie Island — half-way between Buckles Bay and Handspike Bay, "just above beach level", 23.11.1964, *J. Phillips (R.B. Filson 6261)* (MEL); Hasselborough Bay beach, 10.iv.1972, *R. Waterhouse A54* (MEL 1020940).

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NOTES ON *HOVEA* R.Br. (FABACEAE): 5

by

J. H. Ross*

ABSTRACT

Ross, J. H. Notes on *Hovea* R. Br.(Fabaceae): 5. *Muelleria* 7(3): 349–359 (1991). — The name *H. purpurea* Sweet is currently misapplied. The name *H. purpurea* Sweet applies to the taxon hitherto known as *H. beckeri* F. Muell., and the name *H. pannosa* Cunn. *ex* Hook. is to be used for the widespread polymorphic taxon hitherto known as *H. purpurea.*

THE APPLICATION OF THE NAME *HOVEA PURPUREA* SWEET

Sweet (1827) indicated in the protologue of *H. purpurea* that "Our drawing of this beautiful new species was taken in May last, at the Nursery of Messrs Whitley, Brames, and Milne, at Fulham, where it was raised from seed, sent by Mr Charles Frazer (*sic*), from New South Wales; and we have seen fine flowering specimens of it in Mr. Lambert's Herbarium, that were also sent by Mr. Frazer. It is the finest species of the genus that we have yet seen, excepting *H. Celsi (i.e. H. elliptica)*, and differs from all others that we are acquainted with in bearing purple flowers." There is no means of knowing whether the description in the protologue was based solely on the plant in cultivation or whether it was based in part also on the specimens Sweet saw in Lambert's herbarium. However, as the specimens were included in his concept of the species they are significant from the point of view of the typification of *H. purpurea.*

Sweet believed that his *H. purpurea* differed in having purple flowers from all other species with which he was acquainted, whence the specific epithet. The generic diagnosis of *Hovea* in the protologue was copied almost exactly from De Candolle (1825) and Sweet cited De Candolle's Prodromus which suggests that he must have been aware of all of the species treated by De Candolle. De Candolle enumerated *H. longifolia* R. Br., *H. linearis* (Smith) R. Br., *H. lanceolata* Sims, *H. elliptica* (Smith) DC., *H. latifolia* Lodd. *ex* DC., *H. celsi* Bonpl. (a synonym of *H. elliptica*) and *H. chorizemifolia* DC.

The illustration (t.13) is good and the description is fairly comprehensive. Given the difficulties in differentiating some of the taxa in *Hovea*, the description and the plate were studied very closely to establish whether they contain diagnostic information that enable the name *H. purpurea* to be applied with certainty. The colour of the flowers, a character to which Sweet attached so much significance, is not diagnostic and does not help to identify his species.

Sweet's Latin diagnosis is as follows:

> "*H. purpurea*, ramis erectis ferrugineo-tomentosis, foliis oblongo-linearibus obtusis mucronulatis margine revolutis supra glabris reticulato-venosis subtus tomentosis, stipulis subulatis minimis, pedunculis axillaribus geminis, bracteis duobus calyci proximis tertia remotis, calyce ferrugineo-tomentoso".

This diagnosis is supplemented by an English description and relevant supplementary information is as follows:

> 1. the leaves are "rigid, smooth, channelled,.... on the upper side, underneath clothed with a dense wool, which is more or less ferruginous, particularly on the midrib,...".
>
> 2. "Bractes 3, oblong, obtuse, concave, ferruginous, 2 of them close to the calyx, the other about half way down the peduncle".

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3. "Vexillum broader than long, emarginate, with rather a slender unguis,..."
4. "Alae or wings spathulate, concave, with a long blunt ear at the base, more than half the length of the slender unguis."
5. "Keel nearly as long as the wings, sharp, and flat towards the point, where it is very dark purple, but lighter below, also with two long ears at the base nearly half the length of the slender unguis."

As Fraser collected the seed from which the plant illustrated in *'Fl. Australasica'* was grown, and also the specimens seen by Sweet in Lambert's herbarium, it is essential to have some indication of the areas of New South Wales visited by Fraser prior to 1827. Fraser accompanied Oxley's three expeditions in the years 1817, 1818 and 1819 (Froggatt, 1932). The 1817 expedition started from Bathurst and explored the marshy lands of the Lachlan River, returning to Bathurst via the Wellington valley. On the 1818 expedition Fraser collected in New England and along the course of the Hastings River. The 1819 expedition surveyed Port Macquarie and the Hastings River. During his years in New South Wales Fraser also made short collecting forays into the country around Sydney.

As *H. purpurea* is currently understood, the name is applied to one of the most widespread and polymorphic *Hovea* species in eastern Australia. Specimens included in the current concept of *H. purpurea* (for the purposes of this discussion only the variation encountered within the areas from which Fraser could have collected seed or specimens is regarded as falling within the range of *H. purpurea*) differ from the plant illustrated and described in the protologue in the following significant respects:

1. The stipules are conspicuous, 1.5–4 mm long, and not minute as described in the protologue.
2. The bract and bracteoles are acute apically and not obtuse as described. Furthermore, the bract and bracteoles are subulate and not oblong and neither are they concave. Although the bract may be about halfway down the pedicel, it is more usually inserted a little distance under the bracteoles.
3. The auricle on the wing petal is not of the proportions described by Sweet, at least not on any flowers that I have examined.
4. Likewise, I have not observed any keel petal with an auricle of the proportions described by Sweet. Sweet described the keel as being nearly as long as the wings. In *H. purpurea*, as curently understood, the keel petals usually vary from about three quarters to four fifths the length of the wings.

If the plant illustrated and described in the protologue was a specimen of the taxon to which the name *H. purpurea* is currently applied, the above differences are surprising. What is equally surprising is that no specific mention was made in the protologue of the characteristic dense spreading villous hairs on the young shoots, lower surface of the leaves, stipules and on the pedicels. Indeed, the hairs on the pedicel are usually so dense that they obscure the pedicel and make the bract and bracteoles difficult to see. As the current concept of *H. purpurea* does not accord very well with the protologue, this suggests that the name is misapplied.

In view of the suspected current misaplication of the name *H. purpurea*, the identity of the specimens seen in Lambert's herbarium assume great significance. Unfortunately Lambert's herbarium was dispersed after his death and the difficulties associated with trying to locate material that formerly was part of his herbarium are well documented (Miller, 1970). Bentham's (1863) lament concerning Australian species described from material in Lambert's herbarium is as true now as it was then. In response to my request, Mrs K.L. Wilson examined copies of the catalogue at BM and K relating to the sale of Lambert's herbarium. The relevant Lot would appear to be Lot 288, a mixed bundle of Australian collections which named Fraser as one of the collectors represented. The copy of the catalogue in BM annotated at or after the sale has the names of the buyers written in the margins. Lot 288 was purchased by Lemann whose herbarium was presented upon his death to CGE in accordance with his wishes.

The copy of the catalogue in the K archives (bound with the Hooker correspondence with Dawson Turner) was the one sent to Turner and, according to Hooker's accompanying letter, he annotated with the letter "H" those Lots which "I have reason to believe I possess from the same source or nearly of the same kind from other sources". There is a letter "H" against Lot 288.

In response to requests, searches were made on my behalf in all of the herbaria reported by Chaudhri *et al.* (1972) to contain material from Lambert's herbarium, and in some other herbaria besides. No *Hovea* specimens forming part of Lambert's herbarium were located in B, BR, E, F, FI, G, GH, HBG, L, LE, LINN, M, MASS, MO, NY, OXF, P, PH, PR, US or W.

I have succeeded in tracing only three *Hovea* specimens that formed part of Lambert's herbarium. One is in Bentham's Herbarium at K and is labelled by Bentham "Hovea longifolia R. Br. Nov. Holl. Lambert 1832". It is not known who collected this specimen but it is mounted to the right of a specimen of *H. longifolia* collected by R. Cunningham. The specimen from Lambert's herbarium is typical of *H. longifolia* and the long narrow leaves are quite unlike those illustrated for *H. purpurea* in t.13. It is very unlikely that Sweet would have included a specimen of *H. longifolia* in his concept of *H. purpurea.*

There are in CGE two specimens collected by Fraser which formed part of Lambert's herbarium and came to CGE as part of Lemann's herbarium. One is a flowering specimen of *H. rosmarinifolia* and by no stretch of the imagination is it conceivable that Sweet would have included the specimen in his concept of *H. purpurea.* The second is a flowering specimen of *H. lanceolata* which is labelled in Bentham's hand "ex herb Lambert Hovea obtusifolia Sweet ex D Don" (this is a manuscript name). One wonders when Sweet applied this epithet to the specimen thereby indicating that it did not correspond with his *H. purpurea.* It is within the realms of possibility that this is one of the specimens referred to in the protologue of *H. purpurea* by Sweet. This raises the possibility that Sweet included discordant elements in his circumscription of *H. purpurea.* Given the confusion that has existed in this genus almost from the time that the first species was described, this would not be surprising. Of the three *Hovea* specimens I have seen that formed part of Lambert's herbarium, this specimen of *H. lanceolata* is the one that could most easily have been included by Sweet in his concept of *H. purpurea.* There are at BM three specimens and at K one specimen of *H. lanceolata* collected by Fraser but no indication that any of them formed part of Lambert's herbarium. The specimen at K and two of those at BM are reminiscent of the specimen in CGE and it is not inconceivable that they are duplicates. The occurrence of a specimen at K supports Hooker's contention that he had duplicates of many of the Australian specimens offered for sale in Lambert's herbarium.

Unfortunately it has not been possible to locate a specimen collected by Fraser from Lambert's herbarium of the taxon to which the name *H. purpurea* is currently applied, or, more importantly, that matches the protologue. Lambert was generous by nature and during his lifetime gave away many specimens. Usually these would have been duplicates but on occasions it is known that he gave away unique specimens (Miller, *l.c.*). During Lambert's later life he apparently repeatedly asked Hooker to make selections of whatever species he wished from his collections. David Don, while in charge of Lambert's herbarium, may have loaned or given away specimens with or without Lambert's knowledge. In short, almost anything could have happened to specimens that Sweet saw in Lambert's herbarium. In the absence of any specimens from Lambert's herbarium that match the protologue of *H. purpurea*, there is no means of establishing with certainty the identity of the specimens that Sweet saw. All that can be stated is that a specimen of *H. lanceolata* collected by Fraser from Lambert's herbarium exists at CGE and that other specimens of *H. lanceolata* collected by Fraser exist at BM and at K. The possibility exists that one of the specimens seen by Sweet may have been *H. lanceolata.*

It is difficult to assess the probability that a specimen of *H. lanceolata* was included by Sweet in his concept of *H. purpurea*. *H. lanceolata* is a widespread and variable species, but, like the taxon to which the name *H. purpurea* is currently applied, differs in significant respects from Sweet's protologue. The stipules in *H. lanceolata* are minute as described in the protologue but they are not subulate and the leaves are usually narrow-ovate and not linear-oblong as stated in the protologue of *H. purpurea*. The bract and bracteoles illustrated in t. 13 are significantly larger and of a different shape from those of *H. lanceolata* and the shape and size of the corolla of *H. lanceolata* differs from the description given for *H. purpurea*.

There is a specimen at BM of *H. acutifolia* collected by Fraser, but, once again, no indication that it formed part of Lambert's herbarium. In any event, the distinctive leaf shape makes it unlikely that Sweet would have included the specimen in his concept of *H. purpurea* even if it had formed part of Lambert's herbarium.

The inability to locate with certainty the Fraser specimens that Sweet saw in Lambert's herbarium means that reliance has to be placed entirely on Sweet's illustration and description in interpreting *H. purpurea*. This is unfortunate given the difficulties of identification in *Hovea*. However, it so happens that the protologue is adequate to positively identify the taxon to which the name *H. purpurea* should be applied. There is only one taxon in New South Wales in which the keel petals are consistently nearly as long as the wing petals and that is the taxon for which the name *H. beckeri* is being used currently (Ross, 1988). The description in the protologue of *H. purpurea* matches what is currently referred to as *H. beckeri* in almost every respect.

The leaves are much as described by Sweet except that the upper surfaces were described as glabrous. The leaves in *H. beckeri* are usually glabrous apart from some hairs along the midrib. This discrepancy does not appear to be of much significance. The plant described by Lindley (1831) under the name *H. purpurea* was said to have leaves with glabrous upper surfaces and yet the specimen in CGE upon which the description was based quite clearly has hairs along the midrib. The venation on the upper surface of the leaves in *H. beckeri* is not unduly prominent but conspicuous enough to have warranted comment by Sweet. The stipules are minute and subulate as described although sometimes they are narrow-ovate rather than subulate. The description of the bract and bracteoles falls within the range of variation found within *H. beckeri*. The bracts and bracteoles in *H. beckeri* are large as illustrated and vary from oblong, obovate-oblong, obovate to ovate, are usually obtuse apically although occasionally subacute, and are concave or sometimes somewhat cymbiform and match very well those illustrated in t.13, fig.1. The bract is usually inserted close under the bracteoles but may be halfway down the pedicel as described in the protologue. Sweet described the standard as "broader than long". The standard illustrated in t.13 is actually as broad as long and not broader than long. In *H. beckeri* the standard is usually longer than broad. The auricles on the wings are large and, as already mentioned, the keel petals are almost as long as, or sometimes longer than, the wings. Although no scale is given in t.13, the dissections appear to be life-size and show clearly the keel petals as long as the wing petals and the long stamen-filaments. Significantly, *H. beckeri* grows within the areas of New South Wales visited by Fraser.

The consequence of this finding is that the name *H. purpurea* must now be used for the taxon hitherto known as *H. beckeri*, and another name must be found for the widespread taxon until now known as *H. purpurea*. In the absence of any specimens, I here select t.13 in Sweet (1827) as the LECTOTYPE of *H. purpurea*.

The plant illustrated and described under the name *H. purpurea* by Lindley (1831) belongs to the same taxon as that to which Sweet applied the name. Fortunately a fragment of the specimen from the nursery of Messrs. Low & Co. of Clapton upon which Lindley's plate and description were based was preserved by

Lindley and is to be found in CGE. Although of no significance from the point of view of the typification of *H. purpurea*, this specimen in CGE is nominated as a "representative specimen" of my understanding of *H. purpurea* should any difficulty be encountered in applying the name *H. purpurea*.

The taxon to which the name *H. purpurea* must now apply has a sporadic distribution in New South Wales and occurs also in South Australia and Victoria. It seems a quirk of fate that this plant was described by Sweet rather than the widespread and polymorphic species to which the name *H. purpurea* has been misapplied and which would have been so much more readily available and easy for Fraser to collect.

The misapplication of the name *H. purpurea* Sweet appears to date from J. D. Hooker's *'Fl. Tasmaniae'* (1856). Hooker noted under *H. purpurea* "I have not united *H. purpurea* with *H. lanceolata*, though quite unable to trace any character by which the originally described and figured specimens may (without fruit) be distinguished." Hooker's note is indicative of the difficulties experienced in applying names in *Hovea* last century, something that has persisted to the present day.

The next name available for the taxon until now known as *H. purpurea* is *H. pannosa*. When describing *H. pannosa*, W.J. Hooker (1831) adopted A. Cunningham's manuscript name. The plant illustrated was raised at the Botanic Gardens, Kew, from seed collected by Cunningham north of Bathurst and sent in 1823 and the description was based on Cunningham's specimens collected in New South Wales and on the plant in cultivation. It is surprising that W.J. Hooker made no mention whatsoever of *H. purpurea* in the protologue. Instead, he stated that *H. pannosa* approached *H. linearis*, a species that is far more readily distinguished from *H. pannosa* than is *H. purpurea*. Presumably Hooker was confident *H. pannosa* represented a taxon so distinct from *H. purpurea* that there was no need to mention the species. It seems improbable that he was unaware of it. There are at K two sheets of Cunningham material labelled *H. pannosa*. One sheet consisting of two twigs presented by the Linnean Society is labelled "Country N. of Bathurst, N.S.Wales Dec. 187/1822". The other, which formed part of Herbarium Hookerianum, bears three twigs and three labels. The large specimen on the right bears a label which reads "on brushy barren hills East of [?] N. of Bathurst" and pencilled alongside it on the sheet is "Hook. bot. mag. tab. 3053". The specimen on the left has written beneath it "Hovea pannosa All. Cunnm.". The lower central specimen has smaller leaves and a slightly different appearance. In BM there are two sheets collected by Cunningham labelled "187 North of Bathurst, New South Wales A. Cunningham 1822" and a duplicate in NSW from the BM is labelled similarly. In W there is a specimen labelled "Hovea pannosa Cunn. Bot. Mag. Interior of N.S.Wales 1822". These four specimens resemble the larger right hand specimen on the sheet in Herbarium Hookerianum. All of the above specimens are here regarded as SYNTYPES of *H. pannosa*. The flowering specimen mounted on the left hand side of the sheet in Herbarium Hookerianum, which resembles the specimen illustrated in t. 3053, is here selected from among the syntypes as the LECTOTYPE of *H. pannosa*.

It is unfortunate in some respects that the name *H. pannosa* must be applied to the taxon until now known as *H. purpurea* as the name *H. pannosa* has been misapplied over the years to another taxon [*H. planifolia* (Domin) J.H. Ross] from southern Queensland (Ross, 1989).

HOVEA PURPUREA SWEET

Hovea purpurea Sweet, Fl. Australasica t.13 (1827). Lindley *in* Edwards, Bot. Reg.17: t.1423 (1831). LECTOTYPE (here selected): Fl. Australasica t. 13.

Hovea beckeri F. Muell., Linnaea 25: 391 (1853). LECTOTYPE (here selected):

Mt Remarkable, South Australia, Oct. 1851, *F. Mueller* (MEL 106347).

H. longifolia R. Br. var. *lanceolata* (Sims) Benth., Fl. Austral. 2: 173 (1864) *pro parte quoad syn. H. beckeri.*

H. longifolia R. Br. var. *pannosa* (Cunn. *ex* Hook.) Benth., Fl. Austral. 2: 173 (1864) *pro parte quoad syn. H. purpurea* Sweet.

H. longifolia R. Br. var. *longifolia sensu* Weber *in* Jessop & Toelken (eds), Fl. S. Australia 2: 693 (1986) *pro parte quoad* specim. S. Austral.

Shrub to 3 m high, usually multistemmed; branchlets densely clothed with coiled or curled appressed hairs through which scattered longer hairs project or the majority of hairs spreading somewhat, hairs white, grey or tawny. *Leaves* spreading: lamina more or less flat on upper surface on either side of the depressed midrib and the margins slightly recurved, narrow-ovate, elliptic or oblong, 1.2–7 cm long, 0.4–1(–1.7) cm wide, apex obtuse or acute, usually with a short mucro, upper surface dark green, glabrous apart from hairs along the midrib and sometimes occasional scattered hairs elsewhere, venation not unduly prominent, lower surface densely clothed with coiled or curled white or tawny hairs which obscure the surface completely, venation not prominent; petiole 0.2–0.65 cm long, pubescent like the branchlet. *Stipules* narrow-ovate or subulate, 1–2 mm long, 0.5–0.75 mm wide, densely pubescent externally, sometimes reflexed. *Inflorescence* axillary, sessile, mostly 2–flowered. *Flowers* pedicellate, the pedicels 1.5–2.5 mm long, densely pubescent like the branchlet; bracteoles obovate-oblong, oblong or obovate, 2.5–4 mm long, 1.5–2.2 mm wide, obtuse or sub-acute apically, inserted at or a short distance below the calyx, much shorter than to slightly longer than the calyx-tube, densely clothed with appressed to somewhat spreading hairs externally, sometimes glabrescent; bract broadly ovate, ovate or occasionally obovate, 2.2–3.5 mm long, 1.8–3.5 mm wide, often almost cymbiform, obtuse or acute and sometimes slightly reflexed apically, inserted immediately below to 1.5 (very occasionally to 2.5) mm below the bracteoles, glabrescent internally. *Calyx* densely clothed with coiled or curled and scattered longer straighter hairs or sometimes the longer hairs predominant: 2 upper lobes 5.2–8.5 mm long including the tube 2.5–6 mm long, the 3 lower lobes 2–3 mm long, 1.7–2 mm wide. *Standard* 11.5–17 mm long including a basal claw 3–5.5 mm long, 10–15 mm wide, usually longer than wide (occasionally as wide as long), pale to deep mauve or lilac blue with a greenish-yellow basal flare, occasionally white; wings 10.3–15.5 mm long including a basal claw 3–5 mm long, 3.5–4.5 mm wide; keel petals 9.6–15.2 mm long including a claw 3.5 –5 mm long, almost as long as to longer than the wings, 3.5–4.5 mm wide. *Stamen-filaments* 8.5–16 mm long, usually persisting and conspicuous after the corolla has been shed. *Ovary* sessile or almost so, 2–3 mm long, 2–ovulate, pubescent; style 8–14 mm long. *Pods* sessile or almost so, obliquely ovoid or ellipsoid, 1–1.7 cm long, 0.8–1.1 cm wide, densely clothed with appressed hairs externally when young, densely clothed with whitish hairs within. *Seeds* elliptic, plump, 5.5–7 mm long, 3.5–4.5 mm wide, 3.2–3.5 mm thick, olive to blackish-brown, hilum linear, the aril about half as long as or longer than half the length of the seed, orange, with a very small raised lateral lip. (Fig. 1)

H. purpurea has a disjunct distribution with two main centres of development, one in the Flinders Ranges in South Australia from Saint Marys Peak in the north to Mt Remarkable in the south, and the other in eastern New South Wales and far east Gippsland in Victoria. In New South Wales the species occurs sporadically in the Tablelands from Mt Kaputar National Park, the vicinity of Armidale and the Warrumbungles southwards to Bondi State Forest and Nalbaugh National Park near the Victorian border.

There are in MEL three specimens collected by Mueller labelled as having come from the headwaters of the Upper Genoa River but it was felt initially that they were just as likely to have come from New South Wales as from Victoria. There is also a specimen labelled "Head of the Genoa River Victoria" collected by

Fig. 1. *Hovea purpurea*. a — flowering twig, ×1. b — portion of pedicel showing the basal bract inserted below the bracteole, ×4. c — calyx opened out (upper lobes on right), ×4. d — standard, ×4. e — wing petal, ×4. f — keel petal, ×4. g — gynoecium, ×4. h — staminal tube opened out, ×4. i — fruiting twig, ×1. j — seed, side view, ×5. k — seed, hilar view, ×5. a — h from *D.E. Albrecht 964* (MEL), i from *D.E. Albrecht 2320* (MEL), j & k from *N. Wakefield 4508* (MEL).

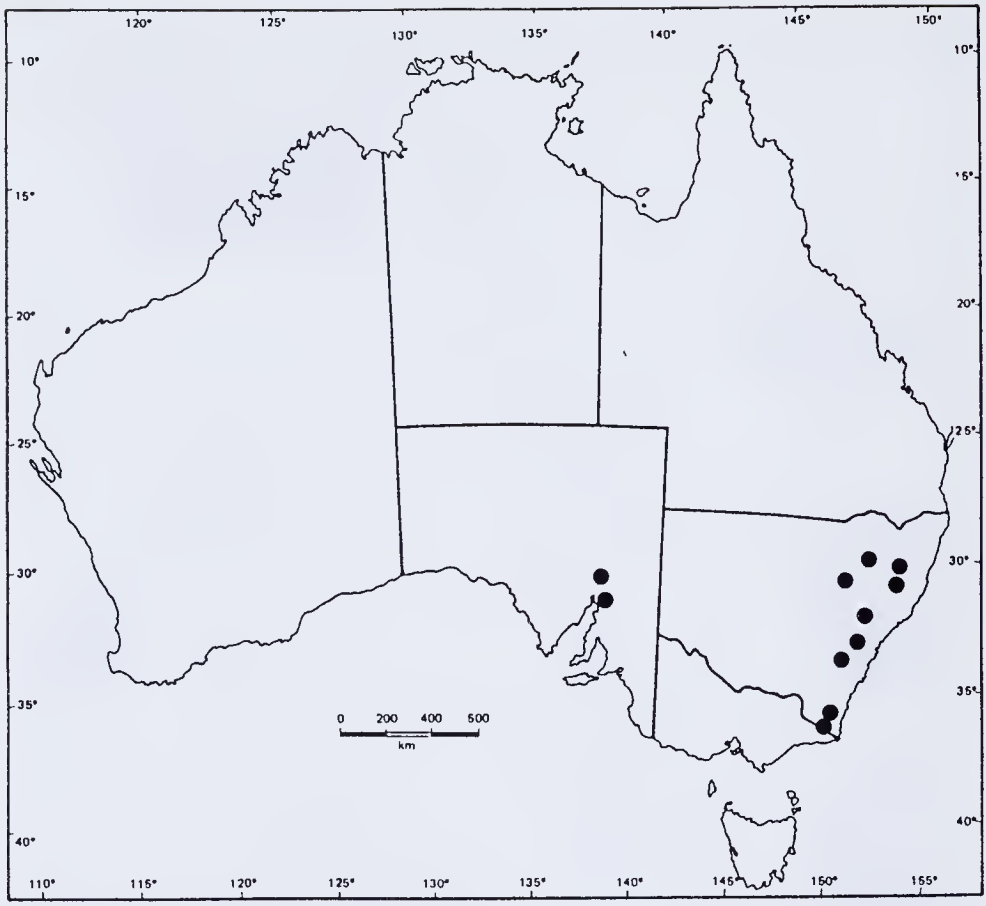

Fig. 2. The known distribution of *Hovea purpurea.*

C. Walter. As Walter was not renowned for the accuracy of his label data, I was reluctant to accept the occurrence of *H. purpurea* in Victoria on the basis of his collection. However, the occurrence of *H. purpurea* on the bank of the Genoa River just inside Victoria was confirmed after an intensive search by my colleagues David Albrecht, Neville Walsh and John Westaway in September 1988. (Fig. 2)

H. purpurea is recorded from a diversity of habitats throughout its distributional range. These vary from rocky alluvial ledges, boulder strewn slopes or Ordovician sediments near or above rivers, granite and sandstone outcrops, rocky slopes below sandstone outcrops, rocky skeletal spurs of metamorphic parent material to outcrops of conglomerate boulders. Recorded from tall Eucalyptus forest to open snow gum-manna gum woodland or grassy slopes with scattered trees, often in very broken country, and usually from altitudes of 240–900 metres except at Mt Kaputar where it is found up to 1380 metres.

REPRESENTATIVE SPECIMENS (total number examined 81):

South Australia — Southern Flinders Range, Mt Remarkable, *c.* 50 km SE of Port Augusta, 4.viii.1956, *H.M. Cooper s. n.* (AD 96413080); Flinders Range, Mt Brown summit, *c.* 20 km E of Port Augusta, 2.x.1958, *D.J.E. Whibley 410* (AD); Northern Flinders Range, St Mary's Peak, Wilpena, *c.* 40 km NNE of Hawker, 9.x.1960, *E.A. Shepley s.n.* (AD 96208169).

New South Wales — Northern Tablelands, Gara River, 14.5 km E of Armidale, 11.ix.1955, *G. Davis s.n.* (NSW 166552); Central Tablelands, Wiaborough Gap on Wiaborough Creek, 13.x.1985, *D.E. Albrecht* 2178 (MEL); Southern Tablelands, E face of Wog Wog Mt, 25.ix.1984, *D.E. Albrecht 964* (MEL).

Victoria — East Gippsland, bank of Genoa River, 500 m downstream from its confluence with Yambulla Creek, 9.ix.1988, *N.G. Walsh 2105, D.E. Albrecht & J. Westaway* (MEL).

TYPIFICATION:

Mueller based his description of *H. beckeri* on material from "Ad latera petraea montis Remarkable et adjacentium". There are in MEL two sheets collected by Mueller in October 1851: the label of MEL 664285 bears the locality "ad latera montis Remarkable & adjacentium montium" and MEL 106347 is labelled as having been collected from "Mount Remarkable" and having formed part of Sonder's herbarium. MEL 106347 consists of three twigs, one of which is sterile. The twig on the left hand side of the sheet has almost finished flowering and the distinctive persistent stamen-filaments and styles are much in evidence. The specimen on the right hand side has larger leaves and is at a slightly more advanced stage of development as very young pods are present. MEL 664285 also consists of three twigs each bearing some young pods which are a little more developed than those on MEL 106347. It is not clear whether the material on the two sheets was collected at the same time either from the same plant or from different plants or whether they were collected at different times. The protologue contains a detailed description of the flowers which was more likely to have been taken from MEL 106347 than the other sheet, whereas the brief mention of the pods was possibly taken from MEL 664285 in which the pods are a little more developed. MEL 106347 is clearly named "*Hovea Beckeri*" in Mueller's hand in contrast to MEL 664285 which he has named "*Hovea longifolia*". In order to obviate any confusion, MEL 106347 is here selected as the LECTOTYPE of *H. beckeri.*

NOTES:

H. purpurea is closely allied to *H. pannosa* and to *H. montana.* It was included by Bentham (1864) in his broad concept of *H. longifolia* under var. *pannosa,* and material from New South Wales was included by Thompson & Lee (1984) under *Hovea* "sp. Q" (*i.e. H. montana*) as a form "which appears to differ only in dimensions of the flower parts, especially of bract and bracteoles" from the typical form of the species.

On account of the affinities between *H. purpurea*, *H. pannosa* and *H. montana*, careful consideration was given to including the latter two taxa in a broad concept of *H. purpurea* and according each subspecific rank. However, despite the existence of an occasional specimen from eastern Victoria and Tasmania which is difficult to place, it seems appropriate to accord *H. pannosa* and *H. montana* specific rank.

H. purpurea appears to be a relatively uniform taxon, and this is especially the case in the isolated South Australian populations. *H. purpurea* is distinguished by having large flowers in which the standard is 11.5–17 mm long including a basal claw 3–5.5 mm long and is usually longer than broad, keel petals which are consistently almost as long as to occasionally slightly longer than the wing petals (0.95–1.05 times as long as the wings), long stamen-filaments (8.5–16 mm long) and a long style (8–14 mm long) which usually persist and are conspicuous once the corolla has been shed, and by the large conspicuous obovate-oblong, oblong, obovate or broadly ovate concave or somewhat cymbiform bracts and bracteoles. This combination of characters differentiates *H. purpurea* from other species.

In *H. pannosa* and *H. montana* the flowers are invariably smaller. The standard is 7–11 mm long including a basal claw up to 3 (very rarely to 3.6) mm long and invariably broader than long so that the proportions of the standard are different to *H. purpurea.* The keel petals are consistently shorter than the wing

petals (0.60–0.91 times as long as the wings), the stamen-filaments and style are correspondingly shorter and not as conspicuous once the corolla has been shed, and the bracts and bracteoles, with few exceptions, are smaller and differently shaped.

Apart from the above, *H. purpurea* differs from *H. montana* in habit: the former is usually a larger shrub with erect stems in contrast to the latter which is usually a small shrub less than a metre high with the outer stems somewhat decumbent or sometimes soboliferous. *H. montana* tends to grow at higher altitudes (1220–1830 metres) on mainland Australia than *H. purpurea* where it is an important component of subalpine heaths.

H. pannosa is an exceedingly polymorphic species widespread in Queensland, New South Wales and Victoria, and the range of variation encountered within it is so great that it tends to obscure the limits of some of the other species.

A variant of *H. pannosa* occurs in eastern Victoria (for example, at the Buchan River Gorge near Native Dog Flat) which has large bracts and bracteoles reminiscent of those found in *H. purpurea*. However, such specimens have all of the other floral attributions of *H. pannosa* rather than of *H. purpurea* and consequently are referred to *H. pannosa*. Another variant from Mt Elizabeth in eastern Victoria and in Tasmania is difficult to place with certainty but, on account of its floral characters, is referred to *H. pannosa* rather than to *H. purpurea*.

HOVEA PANNOSA CUNN. EX HOOK.

Hovea pannosa Cunn. *ex* Hook., Bot. Mag. 58: t.3053 (1831); Beadle, Evans & Carolin, Fl. Sydney Region 3rd edn : 300 (1982). *H. longifolia* R. Br. var. *pannosa* (Cunn. *ex* Hook.) Benth., Fl. Austral. 2: 173 (1864) *pro majore parte* excl. syn. *H. purpurea* Sweet. LECTOTYPE (here selected): Cunningham specimen in Herbarium Hookerianum (K).

Hovea villosa Lindley *in* Edwards's, Bot. Reg. 18: t.1512 (1832). LECTOTYPE (here selected): specimen in Lindley's Herbarium (CGE).

Hovea ramulosa Cunn. *ex* Lindley *in* Edwards's, Bot. Reg. 29: sub t. 4 (1843). LECTOTYPE (here selected): "Upper branches of the Brisbane River Moreton Bay 1829", *Cunningham 35* (CGE; ISOLECTOTYPES: BM, G, K).

Hovea purpurea sensu Thompson & Lee in Lee & Thompson, Fl. New South Wales 101(2): 137 (1984), *non* Sweet.

Lindley based his description of *H. villosa* on a plant cultivated in the nursery of Messrs Rollissons of Tooting grown from seed from New South Wales. Lindley noted how *H. villosa* differed from *H. purpurea* but strangely made no mention in the protologue of *H. pannosa*. *H. villosa* is in fact a much more villous and robust variant of the taxon described the previous year by Hooker under the name *H. pannosa*. There is in Lindley's herbarium at CGE a sheet bearing the name *H. villosa* upon which two specimens are mounted. The smaller specimen has written on the sheet to the right of the base of the specimen "Hort Rollisson 1832", and "Hovea villosa BReg 1512" is written on the sheet in the bottom right hand corner. This sheet clearly represents type material and I here select the larger of the two specimens as the LECTOTYPE of *H. villosa*.

H. ramulosa was based on a Cunningham specimen collected from the upper branches of the Brisbane River, Moreton Bay in 1829. *H. ramulosa* clearly falls within the range of variation of *H. pannosa* and is a synonym of the latter species. The Cunningham specimen named *H. ramulosa* preserved in Lindley's herbarium at CGE numbered 35 and labelled "Upper branches of the Brisbane River Moreton Bay 1829" is here selected as the LECTOTYPE of *H. ramulosa*. A Cunningham specimen in BM labelled "35 Moreton-bay 1829", one in K presented by the Linnean Society and labelled "Upper branches of Brisbane R., N. S. Wales July 35/1829" and one in G labelled "Upper branches of the Brisbane

River Moreton-bay N. S. Wales 1829" and "35/1829" are ISOLECTOTYPES. The Cunningham sheet in K numbered 34 from the Brisbane River is a probable SYNTYPE. The specimen in W labelled "Hovea ramulosa C. Upper branches of the Brisbane River Moreton-bay N.S. Wales 1829" is referrable to *H. lanceolata*.

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A NEW SPECIES OF *MINURIA* DC. (ASTERACEAE: ASTEREAE)

by

P. S. SHORT*

ABSTRACT

Short, P. S. A new species of *Minuria* DC. (Asteraceae: Astereae). *Muelleria* 7(3): 361–367. — A new species, *Minuria multiseta* P. S. Short, is described. It occurs in Western Australia, South Australia and the Northern Territory. Notes on its relationship with *M. gardneri* are provided.

INTRODUCTION

In a revision of *Minuria*, Lander & Barry (1980) recognized three new species, including *M. gardneri* Lander & Barry, a species deemed to be found in both South Australia and Western Australia. Six years later Cooke (1986) recorded in 'Fl. S. Australia' that he had given the species wider circumscription than Lander & Barry, and that the original description was based on 'relatively depauperate material' (Cooke *l.c.*, p. 1473). It is evident, however, that both the original description and that by Cooke encompass two distinct species. The additional species is described below.

METHODS

Data were gathered from herbarium specimens housed in AD, MEL and PERTH. Differences between the two species were statistically examined using a modified *t*-test for unequal variances.

Pollen:ovule ratios have been estimated on a capitulum basis, *i.e.* by counting the number of pollen grains in a single disc floret, multiplying that number by the number of disc florets, and then dividing by the total number of ray florets in the capitulum.

TAXONOMY

Minuria multiseta P. S. Short, *sp. nov.*

Herba perennis, 2.5–34 cm altam, axes majores ascendentes vel erecti, sparsim pubescentes. *Folia* alterna, sessilia, integra, linearia, 5–20 mm longa, *c.* 0.5–1 mm lata, glabra vel sparsim pilosa. *Capitula* solitaria, heterogama, radiata. *Involucrum* 3.8–5 mm diametro, multiseriale; bracteae 35–62, sublanceolatae, *c.* 2–3 mm longae, *c.* 0.4 mm latae, praecipue herbaceae sed marginibus superis et apicibus hyalinis. *Receptaculum* convexum, glabrum, foevatum. *Flosculi radii* feminei, 67–239, corolla 1.9–4 mm longa, ligula 0.9–2 mm longa, alba; cypselae subellipsoidea, 0.6–0.85 mm longae, 0.2–0.3 mm latae, sparsim pubescentes, purpureae; pappus setaceous, setas 8–11, barbellatas, ad basem conjunctae ferens. *Flosculi disci* masculini, 4–25, corolla 1.65–2.4 mm longa, (4)5–loba, lutea; antherae 5, 0.63–0.89 mm longae, sporangiis 0.45–0.72 mm longis, appendicibus terminalibus 0.14–0.22 mm longibus; cypselae steriles, glabrae; pappus cyathiformis, laceratus, setis 2–11 terminalibus, barbellatis.

HOLOTYPUS: 15 km NW of Glendambo along Hwy to Coober Pedy. 30° 53′S, 135° 40′E. Growing in sand on outer edge of saline depression amongst *Halosarcia* and extending up sand dune where it occurs with *Zygophyllum*, 26.viii.1989, *Short 3675* (MEL 1577157). ISOTYPI: AD, CANB, PERTH.

Perennial herb, flowering in the first year, 2.5–34 cm high, major axes ascending to erect, sparsely pubescent. *Leaves* alternate, sessile, entire, linear,

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5–20 mm long, *c.* 0.5–1 mm wide, glabrous or very sparsely hairy. *Peduncles,* with several bract-like leaves, pubescent. *Capitula* solitary, heterogamous, radiate. *Involucre* 3.8–5 mm diam., multi-seriate; bracts 35–62, ± lanceolate, *c.* 2–3 mm long, *c.* 0.4 mm wide, mainly herbaceous but at least the upper margins and apex usually hyaline. *Receptacle* convex, glabrous, pitted. *Ray florets* female, 67–329, in several rows, corolla 1.9–4 mm long, ligule 0.9–2 mm long, white; cypselas ± ellipsoid, 0.6–0.85 mm long, 0.2–0.3 mm diam., sparsely pubescent, red-purple; pappus setaceus, bristles 8–11, barbellate, united at the base. *Disc florets* male, (4) 15–25, the corolla tubular, 1.65–2.4 mm long, 5–lobed, yellow; anthers 5, 0.63–0.89 mm long, microsporangia 0.45–0.72 mm long, terminal appendage 0.14–0.22 mm long; pollen grains 1220–4150 per floret; style arms 0.76–1 mm long; cypselas non-functional, glabrous; pappus a jagged cup c.0.4 mm high with 2–11 terminal, barbellate bristles which are *c.* the length of the corolla tube.

DISTRIBUTION (Fig. 1):

Arid regions of Western Australia, Northern Territory and South Australia, between latitudes *c.* 24° and 31°S, and longitudes 125° and 136°E.

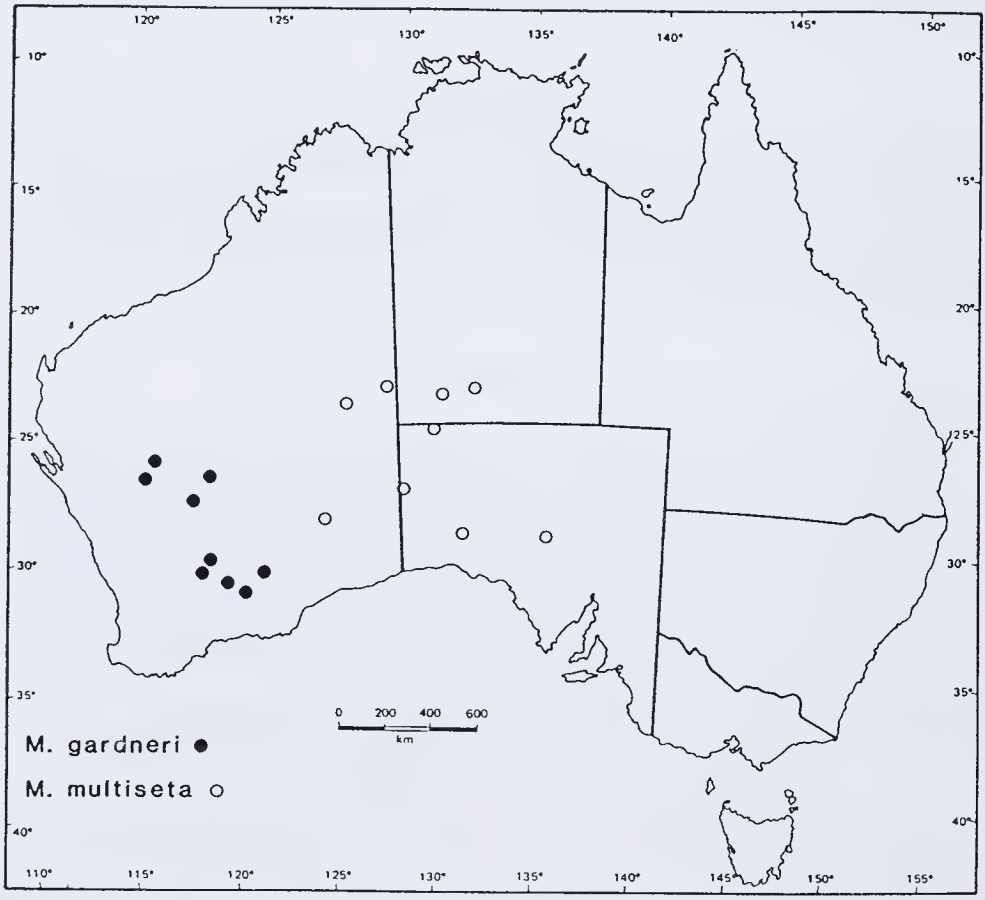

Fig. 1. Distribution of *M. gardneri* and *M. multiseta.*

ECOLOGY:

As with *M. gardneri* this species is most commonly found on the margins of salt lakes. Collectors' notes include: 'in loam over limestone, on rise near salt flat', 'In clay-loam, in myall association', '*Melaleuca* shrubland — shallow soils over gypsum' and 'on gypseous sandy soils of lake bed'.

NOTES:

This species differs from *M. gardneri* by many of the features of the inflorescence noted in (Table I). The *t*-tests show no differences in the number of ray florets and the total number of florets, but statistically significant differences ($P < 0.001$ in each case) are found in the number of disc florets, length of ray corolla and length of ligule, length of disc corolla, anther length, microsporangia length, length of the apical appendage of the anther, and pollen grains per floret. There is overlap in the range of values for some of the aforementioned features, making them impractical for ready identification. However, the species are readily differentiated from one another by absolute differences in the length of the ligule and the total length of the corolla of the ray florets (Fig. 2).

Table I. Comparison of *M. gardneri* with *M. multiseta*

Character	*M. gardneri*	*M. multiseta*
Total number of florets per capitulum	53–255 n = 31 $\bar{x}$ = 137 S.D. = 51.1 S.E. = 9.2	76–259 n = 31 $\bar{x}$ = 164 S.D. = 62.6 S.E. = 10.9
Number of ray florets per capitulum	50–210 n = 31 $\bar{x}$ = 123.5 S.D. = 51.9 S.E. = 9.3	67–239 n = 33 $\bar{x}$ = 143.3 S.D. = 62.5 S.E. = 10.9
Number of disc florets per capitulum	4–23 n = 31 $\bar{x}$ = 10.3 S.D. = 4.7 S.E. = 0.85	4–30 n = 35 $\bar{x}$ = 20.3 S.D. = 5.7 S.E. = 0.96
Percentage ray florets per capitulum	87–95	73–94
Length of ray corolla (mm)	0.75–1.5 n = 28 $\bar{x}$ = 1.18 S.D. = 0.19 S.E. = 0.004	1.9–4.5 n = 63 $\bar{x}$ = 3.54 S.D. = 0.59 S.E. = 0.074
Length of ligule (mm)	0.12–0.4 n = 23 $\bar{x}$ = 0.24 S.D. = 0.71 S.E. = 0.15	0.9–3.2 n = 55 $\bar{x}$ = 2.13 S.D. = 0.56 S.E. = 0.07
Length of disc corolla tube (mm)	0.9–1.6 n = 26 $\bar{x}$ = 1.22 S.D. = 0.21 S.E. = 0.042	1.45–2.4 n = 39 $\bar{x}$ = 1.86 S.D. = 0.21 S.E. = 0.034
No. lobes of disc corolla	3–5	(4)5
No. pappus bristles in disc floret	0–6	2–11

Character	*M. gardneri*	*M. multiseta*
Length of anthers (mm)	0.36–0.64 n = 20 $\bar{x}$ = 0.47 S.D. = 0.01 S.E. = 0.002	0.63–0.89 n = 36 $\bar{x}$ = 0.83 S.D. = 0.087 S.E. = 0.015
Length of microsporangia (mm)	0.3–0.5 n = 19 $\bar{x}$ = 0.39 S.D. = 0.075 S.E. = 0.017	0.45–0.72 n = 36 $\bar{x}$ = 0.64 S.D. = 0.078 S.E. = 0.013
Length of terminal anther appendage (mm)	0.04–0.19 n = 19 $\bar{x}$ = 0.09 S.D. = 0.039 S.E. = 0.009	0.14–0.22 n = 36 $\bar{x}$ = 0.18 S.D. = 0.017 S.E. = 0.003
Pollen grains per floret	360–1828 n = 14 $\bar{x}$ = 1052 S.D. = 555 S.E. = 148	1220–5115 n = 21 $\bar{x}$ = 2895 S.D. = 934 S.E. = 204
Pollen:ovule ratios	35–192 n = 14	68–1442 n = 21

The number of pappus bristles in the disc florets of both species may vary considerably, even within a single capitulum. Furthermore, the disc florets in both species may have 2–6 pappus bristles (Fig. 3). However, the number of bristles is a useful feature by which the species can be differentiated as any single capitulum of *M. gardneri* invariably contains some disc florets which either lack or have only a single pappus bristle. This is not the case for *M. multiseta* as two or more bristles are always present. Although other species of *Minuria* have as many pappus bristles in the disc florets the specific epithet, *multiseta,* has still been chosen for this species as it is unlikely to be confused with any other species but *M. gardneri.*

Disc florets of *M. multiseta* are predominantly five-lobed. Occasional malformed florets with four lobes, but five anthers, have been observed. In *M. gardneri* three, four and five-lobed disc florets, with the corresponding number of anthers, may be found within the same capitulum but more robust plants only tend to have five-lobed florets.

The number of disc and ray florets per capitulum of both species is seemingly influenced by the size of plants and the sequence of the development of capitula, e.g. in the type collection of *M. multiseta* 15–23 disc and 139–239 ray florets were found in fourteen capitula but the smallest, last formed capitulum in one of the smaller plants had only four disc and 72 ray florets. In *M. multiseta* there is also evidence that the number of ray florets is genetically determined. In *Whibley 975* plants, not dissimilar in size and containing a similar number of disc florets (16–28) to many in the type collection, had about half the number of ray florets (49–110) per capitulum. I have also observed similar 'doubling' in forms of *M. integerrima* (DC.) Benth.

The generally larger capitula, the larger ray florets and anthers, the usually greater number of disc florets (*i.e.* pollen-producing florets) per capitulum, and the greater production of pollen grains per disc floret suggest that *M. multiseta* outcrosses to a greater extent than *M. gardneri.* In a number of papers (*e.g.* Short 1981) I have indicated that pollen:ovule ratios (P/O) reflect differences in breeding systems between many species of Australian Asteraceae and P/O values have been determined for these species of *Minuria.* For both species the estimate of the P/O is effected by variation in the number of anthers per disc floret, and the

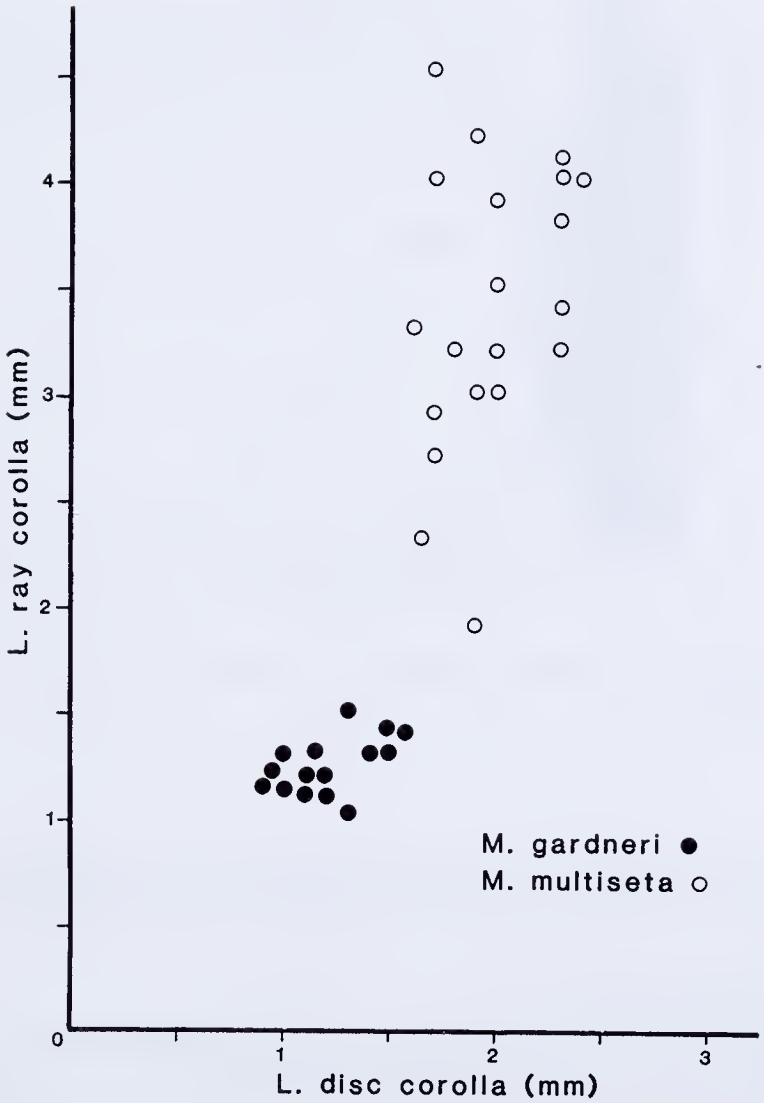

Fig. 2. Length of corolla tube of disc florets and corolla of ray florets in *M. gardneri* and *M. multiseta.*

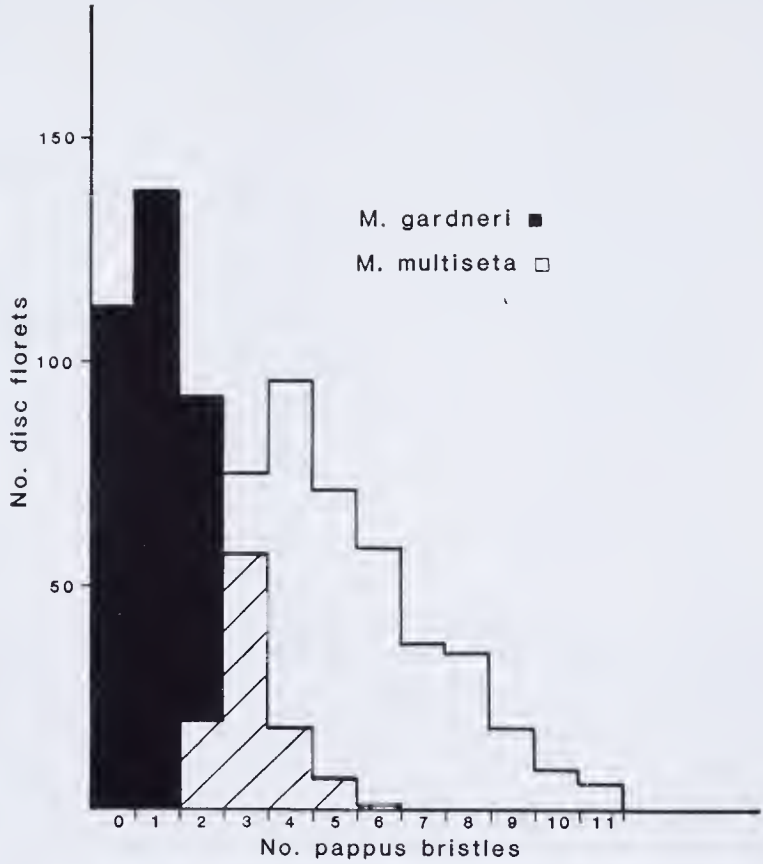

Fig. 3. The number of pappus bristles in disc florets of *M. gardneri* and *M. multiseta*. Overlap zone hatched.

ratio of ray to disc florets. Nonetheless, the range of values obtained (Table I) support the notion that *M. multiseta* outcrosses to a greater extent than *M. gardneri*.

Specimens Examined (Total):

Minuria multiseta

Western Australia — Van der Linden Lakes, 3.x.1966, *George 8235* (PERTH); 110 km N of Seemore Downs, 14.vii.1974, *George 11905* (PERTH); Lake Hopkins area, 9.ix.1978, *Henshall 2171* (PERTH).

Northern Territory — 8 miles S of Wallera Ranch, 23.viii.1973, *Latz 4113* (AD); Lake Amadeus area, 21.ix.1974, *Latz 5724* (AD).

South Australia — 164 km W of Vokes Hill junction, 25.viii.1980, *Alcock 8306* (AD); Serpentine Lakes, 25.viii.1980, *Donner 7407* (AD); 12 km E of Serpentine Lakes, 23.viii.1980, *Symon 12557* (AD, PERTH); 63 km W of Musgrave Park, 6.ix.1963, *Whibley 975* (AD); Lake Yarle, 15.viii.1977, *Williams 9573* (AD); Serpentine Lakes, 21.vii.1979, *Williams 10557* (AD); Serpentine Lakes, 29.vii.1979, *Williams 10694* (AD).

Minuria gardneri

Western Australia — Lake Miranda, near Mt Sir Samuel, 26.vii.1931, *Blackall 330* (PERTH); Western edge of Lake Annean, 28.viii.1986, *Cranfield 5956* (PERTH); 6 miles N of Bulga Downs, 25.ix.1975, *Demarz D5649* (PERTH); Salt lake immediately north-west of Norseman, 13.ix.1971, *Eichler 21261* (AD); Mount Sir Samuel, 26.vii.1931, *Gardner 2426* (PERTH, holo); 5.5 km E of Yellowdine, 4.xi.1983, *Haegi 2550 & Short* (MEL, PERTH); 30 km E of Sinclair Soak, 20.viii.1980, *Newbey 7199* (PERTH); 16 km SW of Jaurdi Homestead, 19.ix.1981, *Newbey 8898* (PERTH); 21 km S of Cue, *Short 2919* (MEL, PERTH); 12 km N of Hyden — Norseman track to Coolgardie, 10.x.1979, *Toelken 6520* (AD); S end of Lake Cowan, 24.vii.1967, *Wilson 6058* (PERTH); Lake Austin, 28.ix.1986, *Wilson 12333* (PERTH).

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Manuscript received 15 March 1990; revised 10 April 1990.

A NEW COMBINATION IN *PTILOTUS* R. Br. (AMARANTHACEAE)

by

P. S. SHORT*

ABSTRACT

Short, P. S. A new combination in *Ptilotus* R. Br. (Amaranthaceae). *Muelleria* 7(3): 369–370 (1991). — The new combination, *Ptilotus eriotrichus* (W. Fitzg. *ex* Ewart & J. White) P. S. Short is made.

PTILOTUS

During the compilation of material for a biography of the botanist William Vincent Fitzgerald (1867–1929) it came to my notice that, in three separate papers (Ewart & White 1909, 1910; Ewart, White & Wood 1911), A. J. Ewart and his colleagues adopted, at least in part, the manuscript names Fitzgerald had applied to six Western Australian taxa. In each case they had herbarium material labelled with Fitzgerald's manuscript names and used these specimens as the basis for their descriptions. Fitzgerald (1912) subsequently published his names, as new, in the *Journal of Botany.*

Amongst the names published by Ewart & White (1910) was *Trichinium eriotrichum* W. Fitzg. *ex* Ewart & J. White. Although adopting Fitzgerald's specific epithet they placed the species in *Trichinium* R. Br., whereas in his later publication Fitzgerald (1912) referred the species to *Ptilotus* R. Br., *i.e. Ptilotus eriotrichus* W. Fitzg. Clearly, as an earlier specific epithet is available, the name *Ptilotus eriotrichus* W. Fitzg. is illegitimate. A new combination is required on the transfer of *Trichinium eriotrichum* W. Fitzg. *ex* Ewart & J. White to *Ptilotus.*

To date no such combination has been made. Benl (1971) and Green (1981, 1985) have adopted the combination *P. eriotrichus* (W. Fitzg. *ex* Ewart & White) W. Fitzg. in, I assume, the belief that Fitzgerald (1912) was not describing a new species, but making a new combination. However, this is incorrect, as it is evident that *Ptilotus eriotrichum* W. Fitzg. was published by Fitzgerald without knowledge of Ewart & White's earlier publication.

That Fitzgerald was ignorant of Ewart & White's work is apparent from several sources. Firstly, in his description Fitzgerald (1912) made no mention of Ewart & White's work. Secondly, subsequent to Fitzgerald's paper in *Journal of Botany,* a note regarding the duplication of the publications, presumably by the editor, James Britten (Anon. 1912), was inserted in the latter journal. Of Fitzgerald it stated in part:

> 'it is right to say that the author is not to blame for this, at any rate in the majority of cases, as his paper had been in our possession some time before its publication, and the species were doubtless undescribed at the time the paper was written' (Anon. 1912, p. 286).

Thirdly, following the latter criticism Ewart (1912) claimed to have made some effort to contact Fitzgerald about the publication of Fitzgerald's names and records that no contact had been made. Unpublished letters at MEL also show that Ewart (1909) wrote in May and August 1909 to Max Koch, the collector of the type material, asking if Fitzgerald's name had been published and whether more material of *Koch 1217* was available. It is, perhaps, not surprising that no response from Fitzgerald was forthcoming. Further letters at MEL suggest that a far from cordial relationship between Ewart and Fitzgerald existed about that time. For example, Ewart (1909), in a letter to J. Staer, refers to the placement of Fitzgerald 'on the Botanical Black list as regard herbarium exchanges'!

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Clearly, Fitzgerald (1912) did not mean to effect a new combination, a situation here rectified:

Ptilotus eriotrichus (W. Fitzg. ex Ewart & J. White) P. S. Short, *comb. nov.*

BASIONYM: *Trichinium eriotrichum* W. Fitzg. *ex* Ewart & J. White, Proc. Roy. Soc. Victoria 22(2): 325 (April 1910). TYPE: 'Cowcowing, *Max Koch,* 1904.' SYNTYPES & ISOSYNTYPES: Cowcowing, Sept. 1904, *Koch 1217,* MEL 1579234; Cowcowing, Sept. 1904, *Koch s.n.,* MEL 1579236; ?NSW *n.v.,* ?PERTH *n.v.*

Ptilotus eriotrichus W. Fitzg., J. Bot. 50: 22 (1912) ('*eriostrichus*'), *nom. illeg.* TYPE: 'Cowcowing; *Max Koch* (no. 1217).' SYNTYPES & ISOSYNTYPES as above.

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Manuscript received 1 May 1990

BOSSIAEA ARENICOLA (FABACEAE), A NEW SPECIES FROM NORTHERN QUEENSLAND

by

J. H. Ross*

ABSTRACT

Ross, J. H. *Bossiaea arenicola* (Fabaceae), a new species from northern Queensland. *Muelleria* 7(3): 371–374 (1991). — *B. arenicola* from the Cook District of northern Queensland is described as new.

INTRODUCTION

Material of this species was first collected almost twenty years ago but it is only relatively recently through the efforts of Mr J.R. Clarkson, Queensland Herbarium, that good flowering and fruiting collections have been made. This opportunity is taken of describing the species.

BOSSIAEA ARENICOLA

Bossiaea arenicola J. H. Ross *sp. nov.* affinitas incerta, forsan *B. brownii* Benth. affinis, a qua foliis majoribus orbicularibus rhombeis ad late obovatis ad basin non manifeste obliquis vel cordatis, stipulis triangularibus vel ovatis, calyce et bracteolis conspicue longitudinaliter striatis, bracteolis majoribus, corolla uniformiter luteola vel interdum vexillo fauce aurantiaco, et ovariis glabriis, differt.

TYPUS: Queensland, Cook District, 4.3 km E of the Hopevale–Starke road on the track to the McIvor River mouth, 14.vi.1984, *J.R.Clarkson 5322* (HOLOTYPUS: MEL; ISOTYPI: BRI, CANB, DNA, K, NSW, PERTH, QRS).

Shrub or tree 2–5 m high with several stems arising from ground level; bark greyish-brown, longitudinally fissured, fibrous; branchlets terete, sparingly to densely clothed with somewhat spreading silvery hairs. *Leaves* alternate, distichous, unifoliolate, reddish when young, on short densely pubescent petioles 1.5–3 mm long; leaflets orbicular, rhombic and sometimes transversely so, to broadly ovate or obovate, (0.6–)0.9–1.8 cm long, (0.5–)0.8–1.9 cm wide, coriaceous, upper surface sparingly to densely pubescent when young but glabrescent, glabrous when mature or with few scattered hairs, midrib and main lateral veins quite prominent, lower surface sparingly to densely pubescent and especially so near the attachment of the petiole, glabrescent, glabrous or with scattered hairs especially basally when mature. *Stipules* triangular or ovate, scarious, sparingly to densely pubescent, 0.7–1.5 mm long, 0.6–1.1 mm wide. *Flowers* borne irregularly on the upper parts of the branchlets, solitary in the axils of the leaves, up to 1.5 cm long, yellow or sometimes the standard with a basal orange flare, on sparingly to densely pubescent pedicels 1.8–4 mm long. *Bracts* few in the series, crowded in the axil, obtuse, up to 1mm long. *Bracteoles* unevenly paired and inserted on the pedicel at different heights, one inserted near the base of the pedicel and the other near the apex, scarious, longitudinally striate, the upper 1.3–3 mm long, 1.5–1.8 mm wide, glabrous apart from marginal cilia, persisting to the fruiting stage. *Calyx* glabrous externally or with a fringe of hairs on the margins, conspicuously longitudinally striate; 2 upper lobes broader than the others and united higher up, the apices of the lobes diverging, 5–6 mm long including the tube 4–4.6 mm long, 3 lower lobes 2–2.5 mm long, shorter than the tube, denticulate. *Standard* spathulate, 14.5–15 mm long including a claw up to

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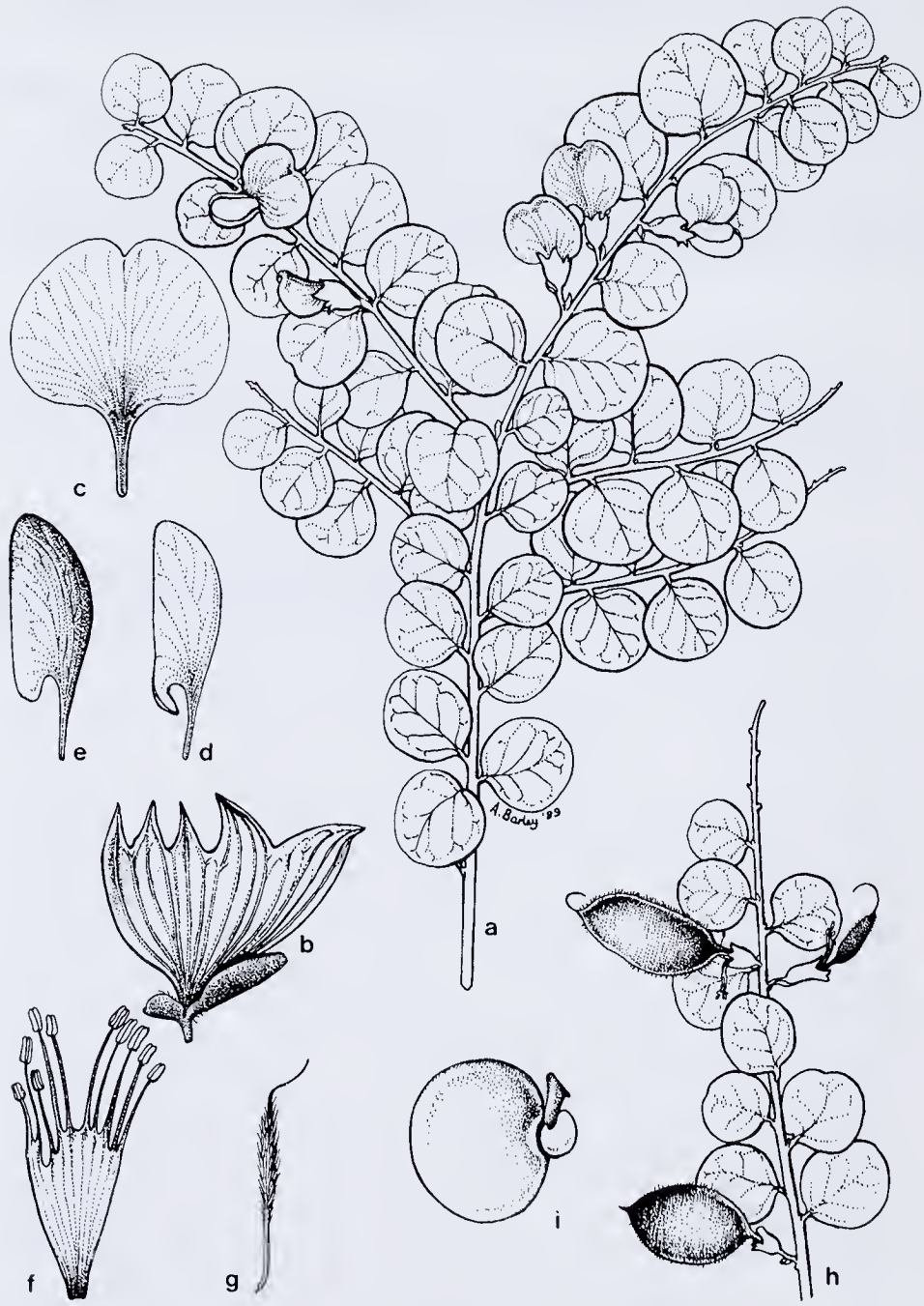

Fig. 1. *Bossiaea arenicola*. a — flowering twig, ×1. b — calyx opened out (upper lobes on right), ×4. c — standard, ×3. d — wing petal, ×3. e — keel petal, ×3. f — staminal tube opened out, ×3. g — gynoecium, ×3. h — fruiting twig, ×1. i — seed, side view, ×5. a–h from *J.R. Clarkson 5322*, i from *J.R. Clarkson 5476*.

5.5 mm long, 10.5–13 mm wide, claw with two calli near the apex; wing petals 11–13 mm long including a claw 3–3.8 mm long, 3–3.4 mm wide; keel petals shorter than or longer than the wings, 12.8–13.6 mm long including a claw up to 3.8 mm long, 4.3–4.9 mm wide. *Stamen-filaments* 9.6–14.5 mm long. *Ovary* 4–4.5 mm long, densely clothed with silvery antrorse hairs, 2–4–ovulate, on a stipe 3–5.2 mm long, the stipe glabrous basally but densely pubescent above; style 6–6.5 mm long. *Pods* oblong or oblong-elliptic, on a stipe which exceeds the calyx, 1.6–2.2 cm long, 0.9–1.3 cm wide, transversely venose, glabrous or with scattered hairs on the margins and surface, coriaceous, margins thickened, dehiscent. *Seeds* transversely ellipsoid, 3.4–3.5 mm long, 4.4–4.5 mm wide, uniformly yellowish-brown but only immature seeds seen, with a hooded cap-like aril. (Fig. 1)

B. arenicola has a fairly wide but disjunct distribution on the eastern side of the Cape York Peninsula between latitudes 11°12′S and 15°20′S. It is recorded from Logan Jack Creek in the north southwards to Shelburne Bay, Olive River, Cape Flattery, Cape Bedford and the vicinity of Hopevale (NW of Cooktown). The species is recorded growing on wind blown sands, on dunes and on river banks in wooded or closed heath, in dense shrubby communities overtopped by scattered trees or shrubs and in rainforest.

REPRESENTATIVE SPECIMENS (10 specimens examined):

Queensland — Cook District, near Logan Jack Creek, 2.viii.1987, *H. Gitay 108* (BRI); coast S of Thorpe Point, Shelburne Holdings, 27.xi.1985, *A. Gunness 1964* (BRI); Olive River, 14. ix.1974, *L.J. Webb & J.G. Tracey 13610* (BRI); 11.9 km W of the Hopevale to Starke road on the track to the McIvor River mouth, 14.viii.1984, *J.R. Clarkson 5476* (BRI, MEL, QRS).

NOTES:

The affinities of *B. arenicola* are not entirely clear. The species is perhaps allied to *B. brownii* Benth. but differs in having larger orbicular, rhombic (and sometimes transversely so) to broadly ovate or obovate leaflets which are not obviously oblique or cordate basally, triangular or ovate stipules, conspicuously longitudinally striate calyces and bracteoles, a uniformly yellow corolla or the standard sometimes with an orange basal flare, and glabrous ovaries.

B. arenicola cannot be accommodated in any of the Series recognized by Bentham (1864). On account of the densely pubescent ovaries the species fits into Bentham's Eriocarpae but, at the same time, the lack of hairy pods and the nature of the upper calyx lobes exclude it from the Series. The densely pubescent ovaries exclude the species from the Series Normales.

B. arenicola has 2–4 ovules, a feature shared with *B. foliosa* Cunn. and *B. oligosperma* A. Lee. Each of the two latter species has much smaller and differently shaped leaves. Although the ovary in *B. foliosa* is densely pubescent, the hairs are ferruginous, whereas the ovary in *B. oligosperma* is glabrous. The ecological preferences and distributional ranges of *B. foliosa* and *B. oligosperma* are quite different to those of *B. arenicola* and the species are unlikely to be confused.

B. arenicola is distinguished at once from *B. rupicola* and *B. carinalis* in that the keel petals are shorter than the standard.

B. arenicola favours sandy situations, whence the specific epithet.

ACKNOWLEDGEMENTS

I am most grateful to John Clarkson, Queensland Herbarium, for making special collections of this species; to my colleague Anita Barley for executing the illustration which accompanies this paper; to Alex George, Executive Editor of the Flora of Australia, for checking the Latin diagnosis; and to the Director and Curator of BRI and QRS respectively for the loan of specimens.

REFERENCE

Bentham, G. (1864) 'Flora Australiensis'. 2: 154–168. (Lovell Reeve & Co.: London.)

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PLECTRANTHUS ARENICOLUS (LAMIACEAE), A NEW SPECIES FROM CAPE YORK PENINSULA, QUEENSLAND

by

PAUL I. FORSTER*

ABSTRACT

Forster, P.I. *Plectranthus arenicolus* (Lamiaceae), a new species from Cape York Peninsula, Queensland. *Muelleria* 7(3): 375–378 (1991). — *Plectranthus arenicolus* P. Forster *sp. nov.*, from west of Temple Bay, Cape York Peninsula, Queensland is described with notes on distribution and habitat.

INTRODUCTION

During botanical exploration of the area between Moreton Telegraph Station and Temple Bay, Cape York Peninsula, I collected flowering material and live plants for cultivation of a species of *Plectranthus*. Using the key published by Blake (1971) for his revision of the genus in Australia and adjacent regions, live material was keyed to *P. gratus* S.T. Blake described from Walsh's Pyramid near Tully. The material from Cape York Peninsula, although tallying in some features with *P. gratus*, differed in a number of significant characters, several of which were extensively used by Blake in his delimitation of taxa.

Some botanists have verbally expressed dissatisfaction with Blake's account of the genus, particularly when dealing with dried material, and have suggested that many of the taxa would be better placed in the synonymy of others. However it should be remembered that his account was based on extensive live collections. From studying a number of taxa native to Queensland both in habitat and subsequently in cultivation, it appears that in most instances Blake's key and description are quite adequate, although the existence of at least two undescribed taxa (from Mt Mulligan and Blackdown Tableland) other than the one described herein tend to lessen the usefulness of his account.

TAXONOMY

Plectranthus arenicolus P. Forster *sp. nov.*, a *P. grato* S.T. Blake caulium base tubera, trichomatibus in caulibus usque 2.7 mm longis, inflorescentiae axe carenti glandulas sessiles, foliis ferentibus tantum 4–6 paris dentium differt.

TYPUS: plant cultivated at St Lucia, Brisbane (from material of the same collection as *P.I. Forster 5456),* 22 October 1989, *P.I. Forster 5835* (HOLO: BRI [2 sheets + spirit]; ISO: K, MEL, QRS).

Subshrub to 30 cm high, foliage slightly scented. *Stems* or lateral branches erect, the lower woody part often straggling and up to 6 mm thick, seedling derived stems with a fleshy tuberous base to 1 cm in diameter; upper parts with a dense indumentum of antrorse 2-8–celled hairs up to 2.7 mm in length but commonly much shorter, lacking gland-tipped trichomes and with shortly stalked glandular hairs to 0.1 mm long on the internode directly below the inflorescence. *Leaves* long-petiolate; lamina ovate to narrowly-ovate, 23–33 mm long, 18–26 mm wide, dull green, somewhat fleshy, paler beneath and colouring purplish in strong light; serrate with 4–6 pairs of short broad teeth, occasionally with one or more secondary teeth; with dense indumentum of antrorse trichomes on both surfaces and occasional sessile yellowish gland below; veins impressed above, prominent below; petiole 7–12 mm long, 1–1.7 mm diameter. *Inflorescence*

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cymose comprising (1)–3 branches; each branch pedunculate, 11–14 cm long; axis with sparse to dense indumentum of antrorse non-glandular trichomes and minute gland-tipped trichomes, lacking sessile glands. *Verticillasters* consistently 10–flowered, 11–12 mm apart, pedicels 3–4 mm long with dense indumentum of minute gland-tipped trichomes. *Calyx* 2.2–2.6 mm long, with a dense indumentum of gland-tipped and eglandular trichomes and sessile yellow glands. *Corolla* 11–12 mm long, deep blue; tube 5.3–5.4 mm long, abruptly curved at *c.* 2–2.1 mm from base at an angle of 90–110°, slightly inflated upwards and then constricted to the slightly oblique mouth, glabrous; upper lobes *c.* 2.5 mm long and 2.5 mm wide, standing more or less erect at between 90 and 110° to the lip, subcircular, with an occasional eglandular trichome and sessile yellow glands; lateral lobes *c.* 2.5 mm long and 1.4–1.5 mm wide, obliquely ovate, glabrous, eglandular; lower lip 5.8–6 mm long, 5.5–6 mm wide, oblique, with sparse indumentum of antrorse eglandular hairs and isolated sessile yellow glands below. *Style* purplish-blue, 8–8.5 mm long and *c.* 2 mm diameter. *Stamens* 4, 7–8 mm long and *c.* 0.2 mm diameter, fused to the tube in the bottom 3 mm; anthers *c.* 0.4 mm long and 0.3 mm wide. *Fruiting calyx* 2.5–3.1 mm long; uppermost lobe 1.5–1.8 mm long and 1.4–1.5 mm wide, broadly ovate, tip acute; lateral lobes 1–1.1 mm long, 0.9–1 mm wide, triangular-falcate; lower lobes 1.5–1.6 mm long and *c.* 0.6 mm wide, narrowly triangular, incurved. *Nutlets* semi-spherical, 0.8–0.9 mm long and 0.75–0.85 mm wide. (Fig. 1)

ETYMOLOGY:

Named for the occurrence of the only known population on a sandstone outcrop.

DISTRIBUTION AND CONSERVATION STATUS:

Thus far, *P. arenicolus* is only known from the type locality. This locality is directly adjacent to the vehicular track that runs due east from Moreton Telegraph Station to the coast near Kennedy Hill. The population examined comprises several dozen plants within an area of approximately 50 m^2, although it is quite likely that further colonies occur off the general area of the road. An appropriate conservation coding is 1R (Briggs & Leigh 1989).

HABITAT NOTES:

Plants of *P. arenicolus* were observed to grow on the top of a sandstone outcrop surrounded by open eucalypt-dominated forest at an approximate altitude of 80 m. Little in the way of other plants were present in this specialised habitat.

AFFINITIES:

Stems with a tuberous base are uncommon in the Australasian taxa of *Plectranthus* (Blake 1971), with *P. parviflorus* Willd. being the only other taxon known to possess this feature, however *P. arenicolus* is not particularly close to this species. *P. arenicolus* differs from *P. gratus* in the stems possessing a tuberous base, the trichomes on the stem being up to 2.7 mm long, the number of leaf teeth pairs being 4–6, and the floral axis lacking sessile glands. The leaves of *P. arenicolus* are also somewhat smaller than those of *P. gratus* (holdings at BRI), although whether this is a result purely of the cultivation conditions remains to be determined. Blake (*l.c.*) grouped *P. gratus* with *P. forsteri* Benth. from the Pacific and *P. apreptus* S.T. Blake from the southern parts of the Cook District in Queensland. Cultivated material of *P. apreptus* (*Forster 4346 & Tucker*, BRI) is immediately distinguishable from *P. arenicolus* by the thinner, glabrous, glossy leaves with 7 to 15 leaf teeth pairs.

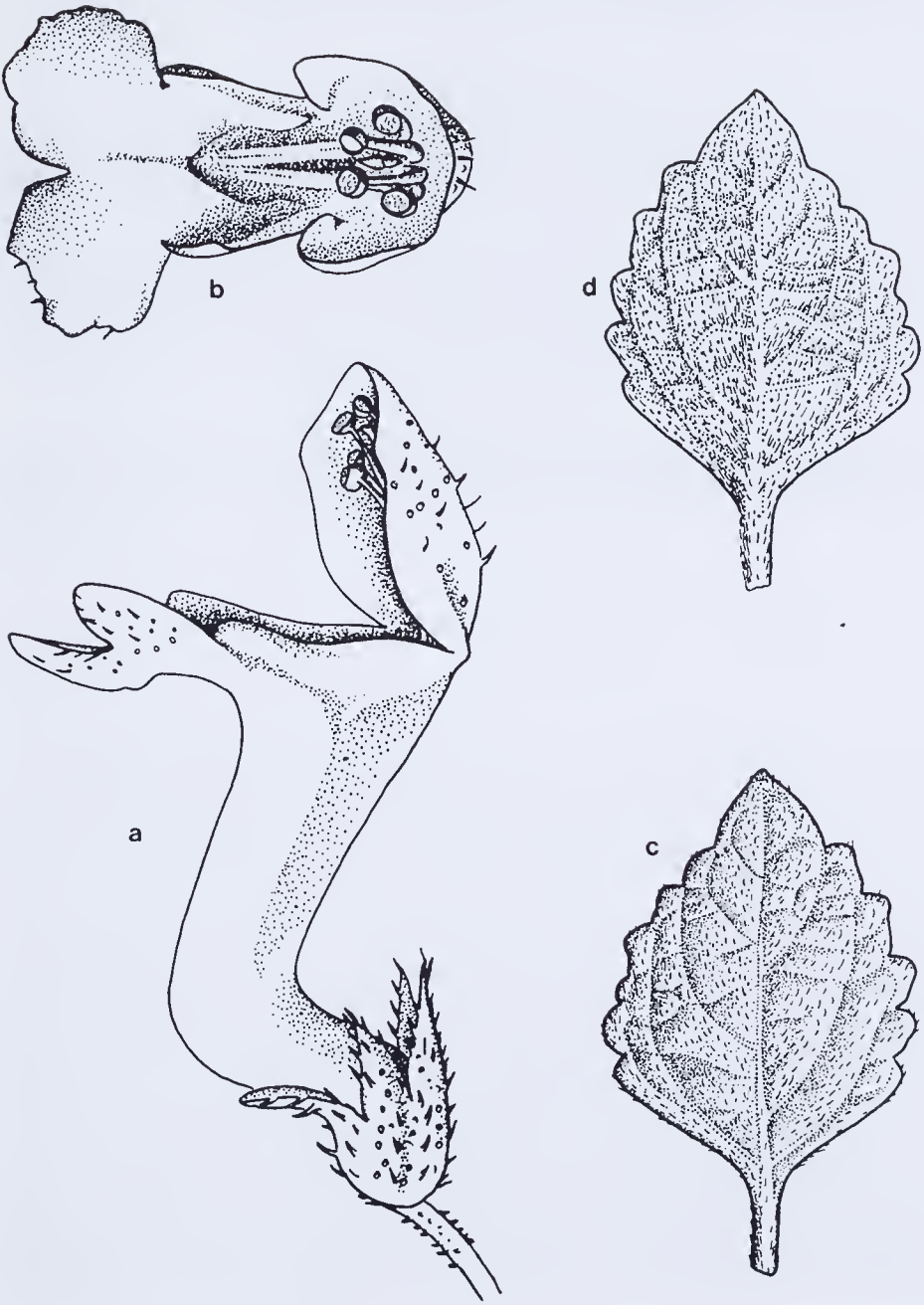

Fig. 1. *Plectranthus arenicolus*. a — lateral view of flower ×10. b — face view of flower ×10. c — leaf viewed from above ×2. d — leaf viewed from below ×2. All drawn from *Forster 5835. Del. L.G. Jessup.*

FURTHER SPECIMEN SEEN:

Queensland — Cook District, 20.9 km east by road from Maloney's Springs, 60.9 km east by road from Moreton Telegraph Station, 22.vi.1989, *P.I. Forster 5456* (BRI).

ACKNOWLEDGEMENTS

L. G. Jessup provided the drawings. Field work on Cape York Peninsula was undertaken with the assistance of G. Kenning, D. J. Liddle and M. C. Tucker. L. Pedley provided the Latin diagnosis. The Directors/Curators of BRI and QRS allowed access to collections at those institutions.

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NEW TAXA IN VICTORIAN POACEAE

by

N. G. WALSH*

ABSTRACT

Walsh. N. G. New taxa in Victorian Poaceae. *Muelleria* 7(3): 379–387 (1991). — Four new species *Poa sallacustris, Poa lowanensis, Danthonia lepidopoda, Deyeuxia talariata* and a new variety *perlaxa* of *Puccinellia stricta* are described and illustrated. Their distribution, habitat, abundance and relationships with other species are discussed.

INTRODUCTION

In the course of preparing an account of the Victorian Poaceae for a forthcoming state flora, several previously unnamed taxa were encountered. The majority of these are presented here. Others requiring further investigation or which are relevant to current research by specialists, will be described if necessary at a later date.

TAXONOMY

POA L.

Poa sallacustris N. G. Walsh *sp. nov.*

P. fordeana F. Muell. affinis sed foliis angustioribus, laevibus, spiculis brevioribus, glumis equalibus vel longioribus quam lemmate inferno et habitatione dissimili differt.

TYPUS: Victoria, Lake Corangamite, SW of Causeway and Lake Martin, 11.5 km SW of Cressy, 27 km NNW of Colac P.O., 12 Sept. 1977, *A.C. Beauglehole 56460 & G.J. Hirth.* (HOLOTYPUS: MEL; ISOTYPI: BRI, NSW).

Rhizomatous perennial, culms ascending to erect, terete to somewhat compressed, to 30 cm high. *Leaves* smooth and glabrous; sheaths tubular in lower part; blades loosely to closely folded, firm, to 12 cm × 2 mm when flattened, abruptly tapered to a keeled, acute, often slightly incurved apex; ligule thinly membranous, acute to obtuse, 1–2 mm long. *Inflorescence* an ovate panicle, to *c.* 10 × 7 cm, the branches bare for the greater part, finally widely spreading; spikelets 4–6 flowered, 5–8 mm long; glumes subequal, 3–nerved, equal to or slightly longer than the adjacent lemmas, smooth or scaberulous along keel; web not or weakly developed; lemma acute, 5–nerved, *c.* 3 mm long, rather firm, lower lemmas mostly with long hairs on the keel in the lower half, and occasionally also along the lateral nerves near the base, the internerves usually glabrous, upper lemmas with rather few, short hairs near base; palea equal to lemma, scabrous along the keels in the upper half, otherwise glabrous or with scattered hairs on the internerve area in the lower half.

OTHER SPECIMENS EXAMINED:

Victoria — Lake Terangpom Wildlife Reserve, 12 Jan. 1979, *A.C. Beauglehole 63155* (MEL, HO, BRI); Krause Swamp Wildlife Reserve 10 Jan. 1979, *A.C. Beauglehole 63036* (MEL, BRI); SW shore of Lake Linlithgow, 14 Dec. 1990, *D. Frood* (MEL); N end of Black Lake, *c.* 15 km NNW of Skipton, 20 Dec. 1990, *D. Frood* (MEL).

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Fig. 1. *Poa sallacustris*. a — ×1/2. b — spikelet ×6. c — florets from upper and lower part of spikelet ×6. All drawn from Beauglehole 56460 (MEL). *Poa lowanensis*. d — habit ×1/3. e — spikelet ×6. f — floret ×6. All drawn from Beauglehole 29505 (MEL). *Puccinellia stricta* var. *perlaxa*. g — habit ×1/3. h — spikelet ×6. i — floret ×6. All drawn from *Albrecht 522* (MEL).

DISTRIBUTION AND CONSERVATION STATUS:

Apparently endemic in Victoria where known only by a few collections from margins of salt lakes west of Melbourne between Colac and Hamilton. Two of the lakes are within wildlife reserves managed primarily for waterfowl. Considering the small number of collections and the abundance of apparently suitable habitat (*i.e.* salt lakes) across the volcanic plain, it is likely that the species has diminished as a consequence of habitat modification through clearing and grazing. Field observations indicate that *P. sallacustris* does not persist following regular grazing (D. Frood *pers. comm.*) Its conservation status is therefore assessed as "vulnerable" with Risk Code 3VCi (Briggs and Leigh 1989).

HABITAT:

All collections of the species are from verges of slightly to strongly saline lakes on the Victorian volcanic plain (Quaternary basalt). The substrates include sticky grey clay, sandy buckshot gravel mixed with basalt pebbles, and at Lake Corangamite, deep deposits of the small aquatic snail *Coxiella striata*. *P. sallacustris* occurs above the saltmarsh zone if such a zone is present at the site. Associated species include *Schoenus nitens*, *Wilsonia backhousei*, *Epilobium billardieranum* and *Plantago coronopus*.

NOTES:

By the closed leaf-sheath, the membranous ligule, rhizomatous habit of growth and lacustrine habitat, *P. sallacustris* is clearly closely related to *P. fordeana* F. Muell. a robust species which occurs chiefly on the Murray River floodplain in Victoria and in similar situations in Queensland, South Australia and New South Wales. *P. sallacustris* is readily distinguished from *P. fordeana* by its overall smaller stature, smooth, narrower leaf-blades, smaller spikelets, and glumes which are as long as or longer than their adjacent lemmas. The saline conditions prevailing where *P. sallacustris* occurs are also quite different from the non-saline, alluvial sites inhabited by *P. fordeana*. The epithet *sal* (salt) + *lacustris* (lakeside), is derived from the species' habitat.

Specimens of *P. sallacustris* have in the past been identified as *P. ensiformis* Vickery, typically a species of wet mountain forests, and the introduced, widespread *P. pratensis* L.. From the former, *P. sallacustris* differs in its non-tussocking habit, its non-membranous lemmas on which the hairs are virtually confined to the midvein and lateral nerves, and in its unpigmented leaf-sheaths. From *P. pratensis*, *P. sallacustris* differs in having firm, acute lemmas with the web not or only weakly developed. Neither *P. ensiformis* nor *P. pratensis* have closed leaf-sheaths or are they characteristic of lacustrine environments.

Collections from Lake Linlithgow and at nearby Krause Swamp differ slightly from others in having lemmas which are sparsely hairy to glabrescent basally, but are consistent in all other features examined.

Poa lowanensis N.G. Walsh *sp. nov.*

P. poiformi (Labill.) Druce affinis sed culmis duplo longioribus foliis plerumque, spiculis purpurascentibus, lemmatis truncatis vel emarginatis, marginibus membranaceis late, et habitatione dissimili differt.

TYPUS: Victoria, Wyperfeld National Park, NE corner of "The Hump", 11 Nov. 1968, *A.C. Beauglehole 29505 & E.W. Finck* (HOLOTYPUS: MEL).

Tufted or shortly rhizomatous perennial, culms erect, to *c.* 90 cm high. *Leaves* usually stiffly erect and sharp-tipped, up to *c.* half as high as the culm, green or somewhat glaucous; sheaths pale or purplish, glabrous, smooth; blades inrolled and 0.5–1.5 mm diam., loosely inrolled or folded, to 3 mm wide when flattened, smooth on the outer (lower) surface, scabrous or scabrous-pubescent on the inner

(upper) surface; ligule truncate, firmly membranous, *c.* 0.5 mm long, minutely pubescent on abaxial surface. *Inflorescence* to *c.* 25 cm long, all branches contracted or the lower sometimes spreading, usually bare of spikelets in the lower half; spikelets 3–6 flowered, 5–7 mm long, usually dappled purple and brownish; glumes 3–nerved, subequal or the lower slightly shorter, 3/4 as long as to subequal to the lower lemmas; web copious; lemma 3–5 mm long, oblong, obtuse, truncate or emarginate, with rather broad membranous margins, often erose at apex, pubescent on the back in the lower half, rarely the internerves glabrous, the keel often long-hairy near the base; palea subequal to lemma, hairy on the back in the lower two–thirds.

SELECTED SPECIMENS EXAMINED (total examined = 16):

Victoria — Wyperfeld National Park, within 3 miles (5 km) of Wonga Hut, 5 Nov. 1960, *A.C. Beauglehole 7151 & J. Landy* (MEL); Wyperfeld National Park, Dingo Swamp, E of Lost Lake, 10 Nov. 1968, *A.C. Beauglehole, 29431 & E.W. Finck* (MEL); Wyperfeld National Park, S of Little Callitris Plain, 11 Nov. 1968, *A.C. Beauglehole 29447 & E.W. Finck* (MEL); Wyperfeld National Park, 1 mile (1.6 km) NW of Quail Lakes, 10 Oct. 1968, *A.C. Beauglehole 29164 & E.W. Finck* (MEL); Wyperfeld National Park, 1 mile (1.6 km) S of Dattuck Track & Cambacanya Clearing, 2 Oct. 1968, *A.C. Beauglehole 28804* (MEL); Sunset Country, 1 km ENE of Spectacle Lake, 9 Oct. 1986, *D.C. Cheal* (MEL).

DISTRIBUTION AND CONSERVATION STATUS:

Known only from north–west Victoria (Big Desert and Sunset Country) with most collections being confined to an area of about 20 × 20 km in Wyperfeld National Park.

The species is regarded here as "rare". All known populations are contained within existing or proposed national parks. The Risk Code is assessed as 2RCa (Briggs & Leigh 1989).

HABITAT:

Occurs in mallee scrub with *e.g. Eucalyptus incrassata, E. socialis, E. leptophylla etc.,* and in *Triodia irritans* tussock grassland developed on deep siliceous sands.

NOTES:

Specimens of this species at MEL were initially tentatively referred by J. W. Vickery to *P. clelandii* Vickery, a species of south–eastern South Australia, southern Victoria and Tasmania, but which differs manifestly from *P. lowanensis* in having typically strongly pigmented, purplish sheaths, flat or folded blades, strongly compressed culms, smaller spikelets, shorter and relatively broader lemmas and the web only weakly developed or absent. *P. lowanensis* is much more closely allied to *P. poiformis,* a common species of southern Australian coasts, which differs in having relatively shorter flowering culms, generally about as long as or sometimes shorter than the leaves, branches of the inflorescence with spikelets virtually to the base, spikelets without purple pigmentation and relatively narrow lemmas which are firm throughout or have only narrow membranous margins.

Lowan mallee is the name which has been conferred upon associations of mallee vegetation on inland sand-dunes and it is from this association, the habitat of *P. lowanensis*, that the specific epithet is derived.

PUCCINELLIA PARL.

Puccinellia stricta (J.D. Hook.) C. Blom var. *perlaxa* Stapf *ex* N.G. Walsh *comb. nov.*.

A varietate typica ramis inforescentiae effusis late sub anthesi et spiculis plerumque flosculis paucioribus differt.

HOLOTYPUS: Victoria, Altona, 3 km south–east of Laverton, 4 km south–south–west of Altona P.O., 25 Nov. 1977, *T.B. Muir 5659* (MEL).

Tufted annual or perennial, culms erect, to 50 cm high. *Leaves* pale green to glaucescent, glabrous; sheaths often rather broad and loose; blades narrow, closely folded or inrolled, to 30 cm × 1 mm; ligule blunt, 1–2 mm long. *Inflorescence* a broad ovate panicle, with fine, widely spreading or sometimes deflexed branches (resembling some *Panicum* spp.), to 30 × 25 cm, usually fully exserted from upper sheath; spikelets mostly 4–5 (rarely 6) flowered, 5–8 mm long, frequently purplish; lower glume 1–2 mm long, upper glume 2.2–3 mm long; lemma 2.5–3 mm long, smooth and glabrous except for a few short hairs near the base; palea subequal to lemma.

SELECTED SPECIMENS EXAMINED (Total examined = 31):

Victoria — Glenthompson, 9 Apr. 1987, *A. Brown 16* (MEL); Beeac, 1963, *A.C. Beauglehole 42599* (MEL); Lake Goldsmith, between Beaufort and Skipton, 15 Jan. 1960, *F. Swindley* (MEL); Lake Werowrap, 13 km NW of Colac, *s. dat. F. Swindley* (MEL); Cobra-Killack Wildlife Reserve, 11 Jan. 1979, *A.C. Beauglehole 63080* (MEL); Lake Corangamite, south-east of Culdare, 14 Oct. 1982, *N.H. Scarlett 82–114* (MEL).

Tasmania — Valley Field Rd, *c.* 3 km SE of Barton Rd (c. 50 km SE of Launceston), 16 Jan. 1987, *D.I. Morris 86176* (HO, MEL).

DISTRIBUTION AND CONSERVATION STATUS:

Scattered in southern Victoria from Port Phillip area in the east as far west as Port Fairy. A single collection from north–eastern Tasmania is known.

The variety is not regarded as rare or threatened in Victoria but its status in Tasmania requires further investigation.

HABITAT:

Like the typical variety of the species, *P. stricta* var. *perlaxa* (and most other members of the genus in Australia), is virtually confined to saltmarsh communities, mostly dominated by *Sarcocornia spp., Halosarcia spp., Wilsonia spp. etc.* Unlike the typical variety however, *var. perlaxa* occurs more commonly in saltmarsh communities fringing salt lakes in south–western Victoria, on heavy soils derived from Quaternary basalt or on *Coxiella* shell deposits. The Tasmanian plants were found growing in a creek bed cutting through pasture paddocks with saline lagoons nearby, on soils derived from dolerite or basalt (D.I. Morris *pers. comm.*). The typical variety in Victoria is known only from coastal sites and sandy margins of salinated water bodies in the northern part of the state (*e.g.* Mildura and Kerang areas).

NOTES:

Some specimens of this entity at MEL have been labelled as the introduced *P. distans* (L.) Parl., a species somewhat resembling *P. stricta* var. *perlaxa* in the diffuse panicle, but differing chiefly in the perennial habit and smaller spikelets and florets (to 6 mm and 2.5 mm respectively). The new variety is readily distinguished from *P. stricta* var. *stricta* in the widely spreading panicle with spikelets having fewer (usually <5) florets, joined by rhachilla segments more slender and longer than those of the typical variety (usually $\geqslant 1/3$ the length of the floret, *c.f.* usually *c.* 1/4 the length of the floret in var. *stricta*). On the basis of these features, it was initially intended to recognize the taxon as a species distinct from *P. stricta*, however, several broadly paniculate specimens exhibit floret characteristics approaching those of the typical form and for this reason the lower status has been adopted here.

Those specimens of somewhat intermediate form occur at sites virtually combining the typical habitats of both varieties, *i.e.* coastal saltmarsh formed on basalt-derived substrates (*e.g.* Altona, Pt Cook, Port Fairy).

P. stricta var. *perlaxa* is the taxon referred to by P.F. Morris in Ewart (1930) as *Atropis* (= *Puccinellia*) *magellanica* Desv., a species indigenous to South America. The application of this name resulted from misidentification of a fragment sent to A.S. Hitchcock (US).

In correspondence to Prof. A. J. Ewart (then Government Botanist at MEL), O. Stapf (KEW) suggested *Puccinellia stricta* f. *perlaxa* to be an appropriate name for specimens submitted to him by Ewart in 1912. Some specimens at MEL were later annotated as *P. stricta* var. *perlaxa*, presumably in the assumption that Stapf had published, or intended to publish this combination. However this work has not been located in any botanical literature and is presumed to have never been validly published. The epithet is appropriate and is here formalized (albeit as a variety rather than a form), hopefully by so doing avoiding any confusion which may have arisen if a new epithet were chosen.

DANTHONIA LAM. & DC.

Danthonia lepidopoda N.G. Walsh *sp. nov.*

Chionochloa pallidae affinis sed statura parviore, foliis planis vel canaliculatis, flosculis parvioribus arista torta vix, pilis lemmatis serie supera caespitosis infirme et a speciebus omnibus *Danthoniae* et *Chionochloae* Australiensis productis plerumque rhizomatis squamatis differt.

TYPUS: Victoria, South Belgrave, "Bullens Land" Courtneys Rd, immediately north of Ash Reserve, 37° 56′40″S, 145°20′45″E, 15.i.1987, *N.G. Walsh 1709,* (HOLOTYPUS: MEL; ISOTYPI: BRI, NSW).

Perennial, developing long, scaly rhizomes. *Culms* to 60 cm high. *Leaves* weakly tufted, glabrous to sparsely hairy; blades flat or channeled, becoming inrolled on drying, to 15 cm long and 2 mm wide; ligule a ciliate rim *c.* 0.5 mm long, with a tuft of longer hairs at the sides. *Panicle* linear to narrowly ovate, to 8 cm long, rather sparse and with few (usually <20) spikelets. *Spikelets* purplish when young, mostly 3 or 4–flowered; glumes subequal, lanceolate, 8–14 mm long; lemma 3–4 mm long, lightly and more or less evenly covered with hairs which are weakly aggregated into tufts in an indistinct, slightly longer upper series; lateral lobes erect, 3–5 mm long, scaberulous, evenly tapered to the 1–2 mm long setiform tips, or setae lacking; central awn weakly twisted in the lower *c.* 2 mm, exceeding lateral lobes by 3–6 mm; palea narrow lanceolate or oblong, far exceeding sinus and approaching or equal to the tips of the lateral lobes.

REPRESENTATIVE SPECIMENS (total examined = 15):

Victoria — Grampians, Mt William, Nov. 1882, *Sullivan* (MEL); Grampians, E side of Victoria Range, 17 Jan. 1969, *A.C. Beauglehole 30296* (MEL, NSW); Grampians, 1.5 miles (*c.* 2 km) ENE of Halls Gap, 21 Dec. 1968, *A.C. Beauglehole 30136* (MEL, NSW); Grampians, Mt Abrupt, 30 Dec. 1968, *A.C. Beauglehole 30216* (MEL, NSW); Otways, *c.* 13.5 km NE of Port Campbell P.O., 22 Mar. 1974, *A.C. Beauglehole 44307* (MEL, NSW); Otways, *c.* 38 km NW of Cape Otway Lighthouse, 20 Mar. 1974, *A.C. Beauglehole 44303* (MEL); Otways, Benwerrin, 9.6 km NNW of Lorne, 3 Jan. 1974, *A.C. Beauglehole 43912* (MEL, NSW); Beenak area, 7.5 km SE of Egg Rock, 10 Jan. 1980, S.J. Forbes 335 (MEL).

DISTRIBUTION AND CONSERVATION STATUS:

D. lepidopoda is apparently endemic in Victoria from where it has been collected from The Grampians mountains, the Otway Range (mostly toward the coast) and the south–eastern slopes of the Dandenong Ranges (some 40 km ESE from Melbourne). Although apparently confined to these three disjunct areas, the species is moderately common in the Grampians and Otways at least (but only two collections have been identified from the Dandenong Ranges area), and is not considered rare or threatened.

Fig. 2. *Danthonia lepidopoda.* a — habit ×1/3. b — spikelet ×3. c — floret ×3. a drawn from *Sullivan s. n.* (MEL); b, c drawn from *Beauglehole 30296* (MEL). *Danthonia talariata.* d — habit ×1/4. e — spikelet ×6. f — floret ×6. All drawn from *Walsh 801* (MEL).

HABITAT:

Occurs on sandy or gritty soils derived from granite or sedimentary rocks, usually in heathland or heathy woodland communities. Associated species have been noted as including *Eucalyptus cephalocarpa, E. willisii, E. sieberi, E. baxteri, E. dives, Banksia spinulosa, Pultenaea mollis, Indigofera australis, Stipa muelleri, Deyeuxia rodwayi* and *Culcita dubia.*

NOTES:

Specimens of *D. lepidopoda* have been in the past been referred to *Danthonia* (= *Chionochloa*) *pallida* or *sp. aff., D. induta* or *sp. aff., D. procera, D. monticola, D. geniculata*, or *D. caespitosa.*

The lemma of *D. lepidopoda* most nearly resembles that of *Chionochloa pallida* in the short, hardly setiform lateral lobes, which are almost equalled by the long-exserted palea and the general indumentum. However, the organization of hairs on the lemma into a weakly tufted upper series and the elliptic, basal hilum of the caryopsis are features characteristic of *Danthonia* (*Notodanthonia*

sens. Zotov 1963) rather than Chionochloa (Zotov 1963) and commits the new species to that genus. Further, *C. pallida* is a robust, strongly caespitose plant, with narrow, involute leaf blades, numerous spikelets per inflorescence, and larger florets with the lemma having a strongly twisted awn, all features not shared by the new species. *Danthonia induta* differs from *D. lepidopoda* in its robust habit, relatively large panicle with numerous spikelets, larger lemma with hairs organized into definite upper and lower series (as well as scattered between the series), longer, strongly twisted awn, and the palea which does not approach the tips of the lateral lemma lobes.

The long-creeping, scaly rhizome is atypical for either *Danthonia* or *Chionochloa* (at least amongst Australian species) and the specific epithet (meaning "scaly foot") refers to this feature.

DEYEUXIA CLAR. EX P. BEAUV.

Deyeuxia talariata N.G. Walsh *sp. nov.*

D. affini M. Gray similis sed spiculis majoribus, 3.6–5 mm longis, arista minuta vel nulla et statura elatiore differt.

HOLOTYPUS: Victoria, East Gippsland, 0.5 km S of Moscow Peak, 2 km NNW of Mt Cobberas no.1, 36°15′50″S, 148°08′45″E, 22 Feb. 1982, *N.G. Walsh 801* (MEL).

Shortly rhizomatous perennial, culms erect, 25–110 cm high. *Leaves* smooth to slightly scaberulous, glabrous or the sheaths sometimes sparsely ciliate along the margin; blades rather stiff, loosely to closely folded, 6–40 cm × 1.5–3 mm when flattened out; ligule membranous, truncate, 1.5–3 mm long. *Inflorescence* a rather dense, cylindrical panicle 4–17 cm long, sometimes interrupted near the base; spikelets 3.6–5 mm long, usually slightly purplish; glumes narrowly acute, subequal, scabrous along the keel in the upper part; lemma acute, equal to or slightly exceeding the glumes, 5–nerved, evenly and minutely scabrous, becoming somewhat hardened at maturity, awnless or shortly awned from apex or just below; awn (when present) straight, to 0.8 mm long, exceeding lemma by up to 0.5 mm; palea slightly shorter than lemma; callus hairs dense, silky, 2/3 to as long as lemma; rhachilla bristle 1–1.5 mm long, plumose, with hairs virtually reaching the apex of the lemma.

OTHER SPECIMENS EXAMINED:

Victoria — Playgrounds, 2 km SW from Mt Cobberas no. 1, 19 Apr. 1981, *S.J. Forbes 917 & H. van Rees* (MEL); Forlorn Hope Track, 10.8 km NNW of Mt Nunniong, 13 Feb. 1980, *H. van Rees 87 & S.J. Forbes* (MEL).

New South Wales — South Coast/Southern Tablelands, Square Swamp, 2.2 km NW of Wog Wog Trig., 21 Feb. 1987, *D.E. Albrecht 3063* (MEL, NSW).

DISTRIBUTION AND CONSERVATION STATUS:

Occurs in eastern Victoria on the Nunniong Plateau and the nearby Cobberas mountains. In south-eastern New South Wales, the species is known from a single collection on the Mt Wog Wog Plateau (inland from Eden). The species is known form only four collections, three of which are contained within National Parks (Cobberas N.P. in Victoria, Nalbaugh N.P. in N.S.W.) but the Victorian sites are subject to grazing by cattle and/or brumbies which are prevalent in the area. The species is here regarded as "vulnerable", with Risk Code 3VCi (Briggs and Leigh 1989).

HABITAT:

At each of the four sites from which it is known, *D. talariata* grows in sodden, *Sphagnum*-rich heath at altitudes above 1000 m. Associated species include *Epacris paludosa, E. breviflora, Baeckea utilis* and *Poa costiniana.* The underlying soils are generally coarse but derived from different bedrocks at each

site (granite, rhyolite and metamorphosed sediments), mixed with abundant organic material.

NOTES:

This species is closely allied to *D. affinis* M. Gray, an uncommon alpine and subalpine species from the Mt Kosciusko area of New South Wales and the Bogong High Plains in Victoria. *D. talariata* is distinguished from *D. affinis* by its greater overall robustness and larger inflorescences and spikelets, and by the minutely awned, or more frequently, unawned lemma. These two species, with *D. parviseta* var. *boormanii,* an uncommon entity from eastern Victoria and southern New South Wales, *D. innominata* D. Morris, from the alps and subalps of southern New South Wales, Victoria and Tasmania, and probably *D. aucklandica* of New Zealand appear to comprise a natural group within the genus, being related by virtue of the long, silky callus hairs, plumose callus bristle and smooth, relatively thin-textured, prominently veined lemma.

The specific epithet meaning "long-skirted" alludes to the long callus hairs encircling the base of the lemma.

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TWO NEW SUBSPECIES WITHIN *EUCALYPTUS LEUCOXYLON* F. Muell. AND NOTES ON THAT SPECIES

by

K. RULE*

ABSTRACT

Rule, K. Two new subspecies within *Eucalyptus leucoxylon* F. Muell. and notes on that species. *Muelleria* 7(3): 389–403 (1991). — Two new taxa within *Eucalyptus leucoxylon* F. Muell. are described, *viz.* ssp. *stephaniae* K. Rule, whose populations are sporadic over the sandy tracts of Upper South-east South Australia and the Wimmera region of Western Victoria, and ssp. *connata* K. Rule, whose markedly depleted populations occur in the vicinity of Melbourne and Geelong. The complex nature of *E. leucoxylon* is discussed, including aspects of its variable morphology and how they relate to its infraspecific taxonomy.

INTRODUCTION

In 1855 Baron von Mueller described *E. leucoxylon* from a specimen collected in the Mt Lofty Ranges to the north-east of Adelaide in an area referred to as the "Devil's Country". The original concept of var. *pruinosa* F. Muell. *ex* Miq. came in the following year and was based on a collection made by Behr at Salt Creek presumed to be in the neighboring Barossa Valley. In 1883 the var. *pauperita* Brown was named to accommodate populations of mallees and stunted trees occurring in drier areas such as the Southern Flinders Ranges. Also described in 1883 was the var. *macrocarpa* Brown. Several other varieties, including var. *rugulosa* F. Muell. *ex* Miq., var. *rostellata* F. Muell. *ex* Miq., var. *erythrostema* F. Muell. *ex* Miq. and var. *angulata* Benth. were erected but did not endure as viable taxa.

Boland and Brooker (1974) completed the first worthwhile survey of *E. leucoxylon* and drew attention to its polymorphic nature. Subsequently, Boland (1978) completed his geographic study of the species and in a second paper (1979) erected four formal subspecies to accommodate the morphological forms he had observed. *E. leucoxylon* ssp. *leucoxylon* Boland replaced var. *leucoxylon* (and others) and included numerous South Australian and Victorian subcoastal populations with medium-sized fruits and non-waxy seedlings. The horticulturally exploited var. *macrocarpa* was replaced by ssp. *megalocarpa* Boland to accommodate non-waxy, large-fruited, large-leaved coastal populations on Kangaroo Island and sites in the Mt Gambier area. Also derived from var. *macrocarpa* was ssp. *petiolaris* Boland which consisted of populations on the Eyre Peninsula and which featured large, ribbed, often campanulate fruits and petiolate, alternate juvenile leaves. The fourth taxon, previously referred to as var. *pruinosa* and var. *pauperita*, was ssp. *pruinosa* Boland which included inland populations from the Southern Flinders Ranges to Central Victoria, its main features being small fruits and adult leaves and waxy juvenile leaves.

Despite Boland's pioneering attempt to bring order to *E. leucoxylon*, there is evidence that his work with the species was incomplete. In fact, two additional forms, each being morphologically distinct and occupying its own discrete habitat and geographical range, have been identified using both field studies and seedling trials. The focus of this paper is on a small-fruited, non-waxy form, whose sporadic populations occur across the extensive sandy tracts of South Australia's Upper South-east and adjacent regions of Western Victoria, and on a second

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Fig. 1. *Eucalyptus leucoxylon* ssp *stephaniae*. a–b — buds, fruits and adult leaves ×1 (drawn from type specimen). c — fruit showing pellicle ×2 (drawn from type specimen). d — juvenile leaves ×1 (from type population).

form, also relatively small-fruited and non-waxy, which occurs on sandstone hills in the vicinities of Melbourne and Geelong.

TAXONOMY

Eucalyptus leucoxylon F. Muell. ssp. **stephaniae** K. Rule *ssp. nov.*

Frutex (mallee) vel arbor parva foliis juvenilibus non glaucis non connatis, adultis ad 12.5 × 2 cm, et fructibus relative parvis plerumque hemisphaericis breviter pedicellatis pellicula membranacea tegenti orificium. A subspecie typica foliis juvenilibus adultisque parvioribus et fructibus non elongatis in pedicellis brevioribus pellicula persistenti differt.

HOLOTYPUS: 9.6 km N of Yanac by road towards Murrayville, 36°05′ S, 141°22′E, 15.v.1985, *K. Rule* (MEL 1527410).

Small mallees to small trees to 15 m. *Foliage* usually semi-weeping. *Bark* pale, sometimes mottled, usually smooth to the ground in mallees or with a short stocking of dark brown fibrous bark at the base in trees. *Seedling leaves* subsessile, ovate-elliptical, decussate for 3 to 5 pairs, blue-green, discolorous. *Juvenile leaves* sessile, opposite, lanceolate to broad-lanceolate or rarely ovate, blue-green, becoming concolorous, non-waxy, non-connate, with bases rounded or rarely slightly cordate, never amplexicaul, to 6.5 × 3.5 cm. *Intranodal extensions* developing at nine to fifteen pairs. *Intermediate leaves* petiolate, alternate, green, lanceolate. *Adult leaves* petiolate, slightly glossy, olive-green to green, lanceolate, to 12.5 × 2 cm. *Buds* 3 (–7), globular to slightly ovoid, yellow, non-waxy. *Ovular rows* 4. *Operculum* obtuse-conical to shortly rostrate, to 7 × 6 mm. *Pedicels* approximately the same length as the buds. *Fruits* non-ribbed, hemispherical or slightly globular-truncate, strikingly burnished, to 8 × 11 mm, always wider than long. *Valves* enclosed to 2 mm below the rim. *Membranous pellicle* regularly persisting over the fruit's orifice. *Locules* 6 (–7). *Pedicels* always shorter than fruit length. *Peduncles* to 8 mm long. (Figure 1)

SPECIMENS EXAMINED:

South Australia — Emu Flat, Sterling Range, 3 miles NE of Keith, 14.vii.1952, *R. Melville 429* (MEL); Ashville, 20 km N of Meningie, 35°31′S, 139°32′E, 22.xi.1959, *P.G. Wilson 1434,* (AD 96022106); 4 miles S of Salt Creek, 35°34′S, 138°55′E, 21.x.1961, *J.H. Willis* (MEL); 17.4 km NW of Padthaway towards Keith, 36°30′S, 140°18′E, 17.vii.1975, *G. Chippendale GC1328* (MEL); 10 km N Coomandook, 35°28′S, 139°42′E, 29.ix.1976, *C.D. Boomsma* (MEL 538686); Box Flat, 34 km SSW of Lameroo, 9.x.1977, *J.G. West 2445* (AD 97811178); Comet Bore, approx. 90 km N of Bordertown (Hundred of Fisk), 35°40′S, 140°50′E, 27.xi.1978, *C.D. Boomsma 460* (MEL 593629); Adjacent to the entrance of the Jip Jip Conservation Park, 36°31′S, 140°25′E, 20.v.1985, *K. Rule* (MEL).

Victoria — 12 miles E of Kaniva, 36°25′E, 141°29′S, 21.ix.1952, 21.ix.1952, *R. Melville 11872* (MEL); Little Desert, S of Miram South, 3.xi.1975, *M. G. Corrick 5360* (MEL 593629); NW Wyperfeld, 35°52′S, 141°58′E, 27.vii.1961 *J.H. Willis* (MEL); Red Bluff, 4.xi.1984, *D. Albrecht* (MEL): 5 km N of Jeparit, 36°05′S, 141°59′E, 2.ix.1986, *K. Rule* (MEL); 30 km W of Rainbow and 5 km S of Chinaman Flat, 35°54′S, 141°00′E, 9.x.1979, *G.C. Cornwall 333* (MEL 598454); 17.7 km S of Murrayville-Pinaroo Rd on track to soak (3 km W of Murrayville), 35°25′S, 141°07′E, 5.ix.1989, *M.I.H. Brooker 10270* (MEL 118383).

DISTRIBUTION (Figure 2):

The distribution of *E. leucoxylon* ssp. *stephaniae* is extensive but sporadic on shallow sands in the desert country of South Australia's Upper South-east and Victoria's Wimmera, from Meningie in the west to Dimboola in the east. Whilst its southern limits are defined by the southern margins of the Victorian Little Desert and similar areas of the same latitude in South Australia, the exact extent of its northern extremity is uncertain. The northern-most herbarium collections suggest it approximates the latitude of 35°25′ S.

ASSOCIATED SPECIES:

E. leucoxylon ssp. *stephaniae* grows in small, but pure stands or occasionally in mixed communities. Where it grows as a mallee, any one of a number of mallee

species occurring across its range may be in the vicinity. Such species observed include *E. diversifolia* Bonpl., *E. rugosa* R. Br. *ex* Blakely, *E. leptophylla* F. Muell., *E. calycogona* Turcz., *E. incrassata* Labill., *E. anceps* (Maiden) Blakely, *E. dumosa* A. Cunn. *ex* Schauer, *E. wimmerensis* Rule and *E. arenacea* Marginson and Ladiges. In the Victorian Little Desert *E. aff. aromaphloia* Pryor and Willis may also be present. Its tree form is usually the dominant species in woodland communities and may be adjacent to or sometimes associated with a number of box species. These include *E. fasciculosa* F. Muell. and *E. porosa* F. Muell. *ex* Miq., in the western part of the distribution, and *E. aff. odorata* Behr *ex* Schlect., *E. largiflorens* F. Muell. and *E. microcarpa* Maiden, in the east.

ETYMOLOGY:

The subspecific name is dedicated to my daughter, Stephanie, who was a constant and enthusiastic companion during *Eucalyptus* field trips and who died suddenly and unexpectedly in October, 1986.

CONSERVATION STATUS:

Usually the populations of ssp. *stephaniae* are small in size and often well separated from each other. Despite this the number of populations is substantial and it is not a threatened taxon.

DISCUSSION:

Most herbarium specimens of ssp. *stephaniae* have been placed under ssp. *pruinosa*. Confusion with this subspecies is understandable as the two are not always separable when using dried adult materials, particularly if those of ssp. *pruinosa* are lacking surface wax and have been collected from small-leaved populations. A few collections, however, have been placed under ssp. *leucoxylon* and, most likely, this has occurred because they exhibited no surface wax.

Clearly the purpose of Boland was to deal with existing informal taxa otherwise he would not have overlooked the taxonomic integrity of ssp. *stephaniae*. He was obviously aware of its presence in Upper South–east South Australia and the Victorian Wimmera. However, his discussion was limited to just a single feature of the populations in the Victorian Big Desert between Murrayville and Yanac, that is, to the membranous pellicle which persists over the fruit's orifice after dehiscence.

Boomsma (1981) also gave attention to the desert populations but, unlike Boland, felt they were worthy of a subspecific status. However, for reasons of his own, he declined from providing a taxonomic treatment.

In the field ssp. *stephaniae* is readily separable from other subspecies when examined at close quarters, and its seedlings are also distinctive. From ssp. *pruinosa* it differs in being non-waxy in both adult and juvenile stages, its juvenile leaves are never connate — a feature which pervades most populations of ssp. *pruinosa* to varying degrees, its mature fruits regularly carry the persisting pellicle and it has a shorter period of juvenility.

E. leucoxylon ssp. *stephaniae* differs from the typical subspecies in having smaller adult and juvenile leaves, and fruits which are usually hemispherical or occasionally slightly globular-truncate, rather than elongated (cylindrical, subcylindrical or barrel-shaped), and which possess the persisting pellicle and shorter pedicels.

Fruit shape and size of ssp. *stephaniae* are similar to those of ssp. *connata* but the latter usually has longer pedicels and rarely the pellicle persisting across the orifice of the fruit. Further, its adult leaves are shorter but there is a small amount of overlap. The two differ most significantly in their juvenile leaves in that those of ssp. *stephaniae* are never connate.

Populations suggesting intermediacy between ssp. *stephaniae* and other subspecies have been observed. Such a case is in Western Victoria, in grazing

Fig. 2. *Eucalyptus leucoxylon* ssp *connata* a — adult leaves and buds ×1 (from Werribee Gorge population). b — fruits ×1 (from Werribee Gorge population). c — fruits ×1 (from Torquay population). d — juvenile leaves ×1 (from Werribee Gorge population).

country to the south of the Little Desert. There, woodland trees, which occupy loamy soils, possess fruits featuring a range of shapes, sizes and pedicel lengths between ssp. *stephaniae* and ssp. *leucoxylon*. However, they are consistent with the latter in other features, particularly in juvenile and adult leaves and in this paper they are included with that subspecies.

Also, in parts of the Wimmera wheatlands, east of the known distribution of ssp. *stephaniae* and in North-central Victoria, populations are intermediate between it and ssp. *pruinosa*. These populations usually have waxy, non-connate juvenile leaves, are small-fruited and rarely exhibit adult surface wax. As well, the period of juvenility is not prolonged as in typical ssp. *pruinosa*. Some collections from North-central Victoria feature small, subcylindrical fruits which resemble those of ssp. *leucoxylon* and have been confused with that subspecies. These populations are regarded herein as ssp. *pruinosa* on the basis of their waxy juvenile leaves.

Eucalyptus leucoxylon F. Muell. ssp. **connata** K. Rule *ssp. nov.*

Arbor foliis juvenilibus ordinate connatis non glaucis, adultis ad 15 × 2.5 cm, alabastris globosis operculo rostrato et plerumque fructibus hemisphaericis in pedicellis longis. A subspecie typica foliis juvenilibus connatis et alabastris fructibusque brevioribus differt.

HOLOTYPUS: 9.8 km W of Bacchus Marsh by road towards Werribee Gorge, 37°40′S, 144°21′E, 28.viii.1985, *K. Rule* (MEL).

Small to medium trees to 20 m. *Bark* smooth, white or light grey, mottled, often with brown, crusty fibrous bark on the lower trunk. *Seedling leaves* subsessile, ovate-elliptical, decussate for 3 or 4 pairs. *Juvenile leaves* sessile, opposite, green or blue-green, discolorous, non-waxy, cordate, or amplexicaul, becoming continually connate by the 8th to 15th pair; rarely non-connate; period of juvenility variable. *Intranodal extensions* usually occurring after the 20th pair. *Intermediate leaves* broad-lanceolate or ovate. *Adult leaves* olive-green to green, semi-lustrous, lanceolate or slightly falcate, to 14 × 2.5 cm. *Buds* globular. *Ovular rows* 4. *Operculum* rostrate. *Fruits* hemispherical or sometimes slightly subcylindrical, with tapered bases, to 8 × 11 mm. *Pellicle* rarely persisting. *Locules* (5–) 6 (–7). *Valves* to 2.5 mm deep. *Pedicels* as long as fruit or slightly longer. *Peduncles* to 11 mm. (Figure 2)

SPECIMENS EXAMINED:

Victoria — Werribee Gorge, 37°39′S, 144°17′E, 22.iv.1912, *P.R.H. St John* (MEL 573160); "Emu Bottom", on Jackson Creek (via Sunbury), 37°29′S, 144°35′E, 20.vi.1971, *J.H. Willis* (MEL 503339); 3 miles towards Steiglitz from Durdiwarrah, 37°53′S, 144°05′E, 6.ix.1966, *E.J. Carrol* (MEL); SW of Torquay, on Sunset Strip adjacent to the T-intersection with Bells Bvd, 38°21′S, 144°19′E, 14.v.1986, *P. Carolan* (MEL 684518); On the Ballan Rd approximately 100 m NW Anakie Junction, 37°53′S, 144°16′E, 26.iii.1987, *K. Rule* (MEL); Studley Park, Kew, 37°47′S, 145°02′E, 8.iv.1987, *K. Rule* (MEL); Greensborough, 37°41′S, 144°06′E, 15.v.1988, *K. Rule* (MEL)

DISTRIBUTION (Figure 2):

Populations of ssp. *connata* are at the south–eastern extremity of the range for the species. They are isolated from other subspecies by the Great Dividing Range in the north and north–west and the generally treeless basaltic plains of Western Victoria in the west. The nearest other subspecies is ssp. *pruinosa* in Central Victoria.

The main concentration of ssp. *connata* is in the Brisbane Ranges between Bacchus Marsh and Geelong where it is a relatively common woodland tree. It also occurs in isolated pockets near the coastal towns of Torquay and Anglesea, in the eastern and outer north–eastern suburbs of Melbourne and in the Sunbury area. It is never in abundance in these isolated populations, obviously due to clearing for farms and urban purposes.

The subspecies is strongly represented in the You Yang Ranges but this occurrence should be treated with caution as it appears to have been derived from an artificial seeding program of many decades ago.

E. leucoxylon ssp. *connata* grows in hilly terrain on soils derived from ancient silurian sandstone where it is usually found on well-drained slopes and ridges.

ASSOCIATED SPECIES:

Like other subspecies of *E. leucoxylon*, ssp. *connata* usually grows in pure stands but numerous other species are found in the vicinity. These include *E. melliodora* Cunn. *ex* Schauer, *E. sideroxylon* Cunn. *ex* Woolls ssp. *tricarpa* L. Johnson, *E. ovata* Labill., *E. viminalis* Labill. ssp. *viminalis*, *E. polyanthemos* Schauer, *E. macrorhyncha* F. Muell. *ex* Benth. and *E. obliqua* L'Herit. Above the Djerriwarrh Creek near Bacchus Marsh, the disjunct population of *E. behriana* F. Muell. is nearby. Of these, *E. melliodora* is the one with which it is most likely to be confused, but the two are easily separable using buds, fruits and juvenile leaves. *E. melliodora* also is a close relative and hybrids are not uncommon where they abut.

ETYMOLOGY:

The name is derived from the connate juvenile leaves which occur regularly in the subspecies.

CONSERVATION STATUS:

The numbers of ssp. *connata* are plentiful along the Brisbane Ranges, but elsewhere it has suffered heavy losses. Some populations are secure in protected reserves, such as the Brisbane Ranges National Park and Studley Park, but conservation authorities should act to preserve whatever they can of the remnant populations.

DISCUSSION:

In his 1978 study Boland included a population from near Meredith in the Brisbane Ranges about 50 km to the east of Melbourne. In his 1979 revision, he included it with other subcoastal populations in Western Victoria and regions adjacent to Adelaide under ssp. *leucoxylon*. However, the majority of his trial seedlings possessed connate juvenile leaves, a feature which also has been observed in the waxy subspecies but never in non-waxy populations west of the Brisbane Ranges. Subsequently, ssp. *leucoxylon* and ssp. *pruinosa* were erected on the basis of differences other than connation. Effectively, that created a dichotomy within the former — a strong expression of connation in the eastern populations and no connation in those in the west. His decision to suppress connation as a taxonomic character was a conservative one and even if this position is maintained the weight of other differences cannot be ignored.

E. leucoxylon ssp. *connata* also differs from the typical subspecies in having a longer period of juvenility. Seedling trials have shown that intranodal extensions rarely occur before the 20th node. Although not common, relatively mature trees have been observed still carrying intermediate leaves, a feature not uncommon in ssp. *pruinosa*. It is also an infrequent occurrence that some seedlings have a rapid period of juvenility. Such seedlings invariably have aberrantly narrow juvenile leaves and usually develop intranodal extensions by the 10th pair. Short petioles also appear at this stage or soon after. Even though these seedlings behave like those of typical ssp. *leucoxylon*, it is strongly suspected that they are of hybrid origin with *E. melliodora* as the other parent.

Whilst the adult leaves of ssp. *connata* are only marginally shorter than those of ssp. *leucoxylon*, there are, however, significant other differences between the two. The buds of ssp. *connata* are globular rather than elongated, as in ssp.

leucoxylon, and its fruits regularly wider than long whilst those of ssp. *leucoxylon* are longer than wide or less often approximately equal in length and width. The fruits of the ssp. *connata* also differ from those of ssp. *leucoxylon* in possessing shallower valves, never deeper than 2.5 mm compared with a range between 2 mm and 4 mm. Further, they have never been observed with the sunken style base, a feature observed consistently in the fruits of South Australian populations of ssp. *leucoxylon*.

From ssp. *pruinosa* the new subspecies is easily distinghished in being non-waxy. Also, the fruits are usually on longer pedicels and, with a few exceptions (those of the very waxy populations of South-east South Australia) are appreciably larger.

Differences with ssp. *stephaniae* have been discussed above.

In Victoria, across the northern fringes of the Grampians as far east as Ararat, the non-waxy populations possess a range of fruit shapes which are mostly elongated. A few fruits, however, are hemispherical and could be mistaken for those of ssp. *connata*. These cases are here regarded as aberrant forms of ssp. *leucoxylon*.

Key to Infraspecific Taxa within *E. leucoxylon*

1. Wax present at least on juvenile leaves ..... *ssp. pruinosa*
1. Wax absent from all structures 2

2. Fruits with collar of lobes surrounding base of style; juvenile leaves petiolate, alternate ..... ssp. *petiolaris*
2. Fruits without the collar of lobes; juvenile leaves sessile, opposite 3

3. Fruits longer than 1.2 cm and wider than 1.1 cm; adult leaves usually wider than 2.5 cm ..... ssp. *megalocarpa*
3. Fruits smaller than 1.2 cm long and 1.1 cm wide; adult leaves less than 2.5 cm wide 4

4. Pedicel approximately half the length of the fruit, persisting pellicle present on mature fruits ..... ssp. *stephaniae*
4. Pedicel equal to or longer than fruit, pellicle rarely persisting across orifice of mature fruit 5

5. Fruits hemispherical or sometimes subcylindrical, buds globular, juvenile leaves usually connate ..... ssp. *connata*
5. Fruits subcylindrical, cylindrical or barrel-shaped, buds elongated, juvenile leaves never connate ..... ssp. *leucoxylon*

NOTES ON E. LEUCOXYLON F. Muell.

The ancestral *E. leucoxylon*'s ability to adapt to a wide range of climates and soils has produced an equally diverse number of morphological variants, six of which are divergent enough to be recognised as infraspecific taxa. It is indisputable that it is an exceedingly complex species which has been a constant source of torment to taxonomists and observers over many years. Below several perspectives, which address some of the problems associated with its infraspecific taxonomy, are offered (Table 1).

Connation:

Taxonomists of the eucalypts have been conservative in dealing with connation in juvenile leaves and this suggests that it is either unimportant or its significance is not completely understood. Connate juvenile leaves occur only in

Table 1. Comparisons between the subspecies of *E. leucoxylon* F. Muell.

Characters	ssp. *leucoxylon*	ssp. *petiolaris*	ssp. *stephaniae*	ssp. *megalocarpa*	ssp. *pruinosa*	ssp. *connata*
Juvenile Leaves:						
Size	to 10.5 × 7 cm	to 7 × 5 cm	to 6.5 × 4.0 cm	to 8.5 × 7 cm	to 8 × 7.5 cm	to 7 × 6.5 cm
Shape	cordate to broad-lanceolate	ovate or broad-lanceolate	lanceolate, broad-lanceolate or ovate	cordate or broad-lanceolate	cordate, occasionally broad-lanceolate or broad-ovate	cordate or rarely broad-lanceolate
Surface wax	absent	absent	absent	absent	present	absent
Basal features	connation absent, amplexicaul and/or cordate bases usually present	connation absent, rounded	connation absent, rounded, rarely cordate and never amplexicaul bases	connation absent, rounded, cordate, or occasionally amplexicaul bases	continual connation present (less frequent in South Australian populations), mixed with rounded, cordate and/or amplexicaul bases	Continual connation mixed with amplexicaul, cordate and/or rounded bases
Petioles	absent	present	absent	absent	absent	absent
Ontogeny:	lanceolate pairs and intranodal extensions present by the 15th pair	intranodal extensions occur by 6th pair	intranodal extensions between 9th and 20th pairs	juvenility variable but not as rapid as ssp *leucoxylon* or ssp *stephaniae*. Intranodal extensions usually occurring after 25th pair	sessile, opposite juvenile pairs persisting indefinitely. Some mature trees may retain pre-adult leaves	variable, but intranodal extensions rarely occurring before the 20th node. Intermediate leaves sometimes retained in relatively mature trees
Adult Leaves:						
Size	to 18.5 × 2.5 cm	to 15 × 2.5 cm	to 12 × 2 cm	to 16 × 3.5 cm	highly variable, to 20 × 2.5 cm	to 14 × 2.5 cm
Petiole length	to 2.5 cm	to 2.0 cm	to 2.0 cm	to 2.5 cm	to 2.5 cm	to 2.0 cm
Buds:						
Shape	ovoid	ovoid, cylindrical or clavate	globular	ovoid	globular	globular
Ovular Rows	4 to 6	6 to 8	4	4 to 6	usually 4	4 or rarely more
Operculum:						
Shape	rostrate to beaked	conical to beaked	obtuse-conical to rostrate	conical, rostrate or beaked	conical to short rostrate	rostrate
Ribbing	absent	light	absent	absent	absent	absent

Characters	ssp. *leucoxylon*	ssp. *petiolaris*	ssp. *stephaniae*	ssp. *megalocarpa*	ssp. *pruinosa*	ssp. *connata*
Fruits:						
Size	to 12 × 10 mm	to 16 × 14 mm	to 8 × 11 mm	to 17 × 14 mm	to 9 × 14 mm	to 8 × 11 mm
Shape	subcylindrical, cylindrical or barrel-shaped	campanulate, subcampanulate or subcylindrical	hemispherical or slightly globular-truncate	globular-truncate, subcylindrical or barrel-shaped	hemispherical or rarely subcylindrical	hemispherical or sometimes subcylindrical
Valve Depth	to 4 mm	to 4 mm	to 2 mm	to 6 mm	to 2 mm	to 2.5 mm
Ribbing	occasionally only light	light to conspicuous	absent	only very light, if present	absent	absent
Locules	5 (–6)	5 or 6	6 (–7)	5 (–6)	6 (–7)	(5–) 6 (–7)
Pellicle	never persisting	absent	persisting	never persisting	rarely present	rarely present
sunken style base	present in South Australian populations	absent	absent	absent	absent	absent
Lobed collar (surrounding style base)	absent	present	absent	absent	absent	absent
Pedicel length	equal to length of fruit or longer, to 15 mm	to 18 mm	less than fruit length	to 20 mm	usually shorter than fruit	to 12 mm
Peduncle length:	rarely shorter than pedicel, to 15 mm	to 20 mm	to 11 mm	to 20 mm	to 11 mm	to 12 mm
Adult Wax:	absent	absent	absent	absent	present but level is variable	absent
Habit:	small to medium trees to 25 m	robust mallees or small trees to 12 m	small mallees, robust mallees or small trees to 15 m	mallees or small trees to 15 m	mallees or small to medium trees to 20 m	small to medium trees to 20 m

a few species of *Eucalyptus* and the feature has been used as a taxonomic character in such cases, but only in support of other characters in separating pairs of related taxa. It is doubtful, for example, whether *E. uncinata* Turcz. and *E. discreta* Brooker could stand apart as separate species just on the presence or absence of connate juvenile leaves. The circumstances are similar in the case of *E. gamophylla* F. Muell. and *E. odontocarpa* F. Muell. Clearly the condition is an observable character, as are surface wax, a particular fruit shape, a collar of lobes surrounding the base of the style and so on. Whilst the cases cited above are concerned with differences between species, the focus of this paper is on infraspecific taxonomy and, in that context, connation becomes a more potent character.

Connation in ssp. *pruinosa* presents taxonomic difficulties, particularly as it exists across the total distribution. In Central Victoria from Euroa to Stawell, non-connate seedlings are the exception, but in populations to the west, including the type locality (the Barossa Valley), it is the reverse. Clearly there is an east–west continuum of connation which, together with the presence of surface wax and aspects of fruit morphology, contributes to linking an indeterminant number of populations into a taxonomic unit. Until new evidence is forthcoming, this position remains justifiable.

Fruit Size and Shape:

Fruit sizes within *E. leucoxylon* have been referred to as large, medium and small. Boland used the combined length of fruit and pedicel to distinguish between his subspecies; less than 1.5 cm (ssp. *pruinosa*), less than 2.5 cm (ssp. *leucoxylon*) and 2.5 cm or longer (ssp. *megalocarpa*). This is a reasonably reliable means of identification but there are some exceptions. For example, there are populations of ssp. *leucoxylon* on the Fleurieu Peninsula and Kangaroo Island, which have some oversized fruits on relatively long pedicels, and others across the northern fringes of the Grampians, where medium-sized fruits sometimes have markedly long pedicels, and in small fruits of ssp. *connata*, this is a reasonably reliable means of identification. Further, throughout populations of ssp. *connata*, the combined length of fruit and pedicel is sometimes less than the lower limit of the medium-sized category. However, ssp. *stephaniae*'s total length rarely reaches 1.5 cm and this compatibility with Boland's prescription for small fruits appears to be diagnostically useful.

With regard to fruit shapes, each subspecies can overlap with other subspecies. It would therefore be imprudent for the observer to place too much value on this aspect of morphology. To illustrate this point, although the usual shape of ssp. *connata*'s fruits is hemispherical, which contrasts well with the elongated ones of ssp. *leucoxylon*, those that are subcylindrical can lead to confusion between the two subspecies.

The convergence of fruit of ssp. *stephaniae* and ssp. *pruinosa*, where the usual shape is hemispherical, is also a source of difficulty. This similarity has contributed to the confusion between these two. Further, the shapes of these subspecies invite confusion with ssp. *connata*. Yet again, other characters are required to aid identification.

The Sunken Style Base:

The sunken style base can be observed in a small pit, which is up to 2 mm deep, in the well of the fruit after the withered style has become detached. Its presence is lost once dehiscence occurs. Occurrences in *E. leucoxylon* fruits have been observed only in South Australian populations of ssp. *leucoxylon* and in the cultivar, "var. *rosea*". The condition has been given little attention as a taxonomic character, although Boland noted its presence in the flowers of many populations of the species in his 1978 study. However, observations suggest that its manifestation in fruits is limited.

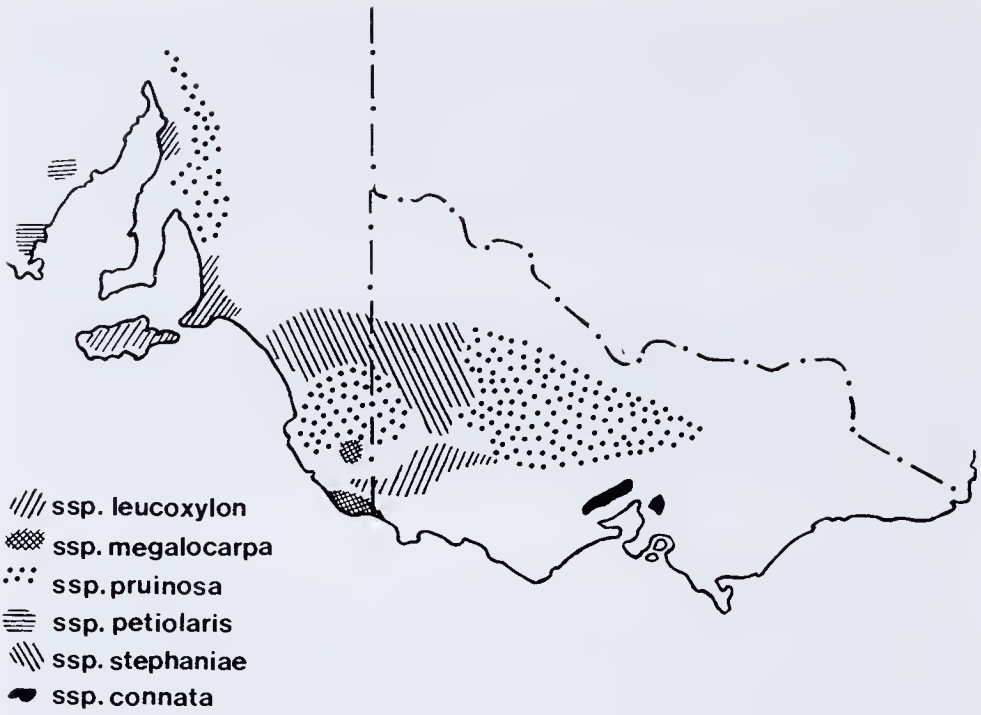

Fig. 3. Distribution map of *Eucalyptus leucoxylon* subspecies.

The sunken style base could prove a useful taxonomic tool for distinguishing between ssp. *leucoxylon* and other non-waxy subspecies where there are similarities in fruit sizes. Such a case exists on the Fleurieu Peninsula and Kangaroo Island where the presence of ssp. *megalocarpa* has been disputed by some authorities. Most certainly it has been considered as a taxonomic criterion in the segregation of ssp. *connata* from the typical subspecies, but only at a minor level. The condition has not been observed in other Victorian non-waxy populations adjacent to the Grampians and in the south-west of the state but they have been retained within ssp. *leucoxylon* on the grounds that their adult and juvenile features are consistent with that subspecies.

THE PELLICLE:

Both Boland (1978) and Boomsma (1981) implied that only the desert populations of *E. leucoxylon* possessed the pellicle. To the contrary, field observations have revealed a few cases of its presence in both ssp. *pruinosa* and ssp. *connata*. Of these, it tended to be more common in the former.

Obviously the phenomenon of the persisting pellicle needs clarification. In the fruits of all subspecies of *E. leucoxylon*, except ssp. *petiolaris*, the ovary roof is covered by a thin layer of pale tissue which is the precursor of the pellicle. Whether or not it matures and remains wholly or partly intact after dehiscence appears to be related to the fruit's age and its structure. In all cases observed, both in ssp. *stephaniae* and other subspecies, the fruits had reached maturity and had relatively shallow valves and broad orifices.

Boland also suggested that the pellicle was a mechanism for retaining fertile seeds in adverse climatic conditions. Another attribute of ssp. *stephaniae* is its ability to retain large crops of fruits over several seasons which permits not only the retention of seeds, but the development of the pellicle. This combination

appears to be one of the strategies which the subspecies has developed to meet its reproductive needs.

ADULT LEAF SIZES:

The traditional perspective of leaf sizes within *E. leucoxylon* has been that ssp. *megalocarpa* has the largest and ssp. *pruinosa* the smallest, with ssp. *leucoxylon* somewhere in between. Most certainly ssp. *megalocarpa* has the broadest, but when the dimension of length is considered nothing is clear-cut. In fact, each subspecies shows considerable variation and at best leaf lengths are unreliable characters. Of all the subspecies, only the lengths of ssp. *stephaniae* offer any value as taxonomic aids and that is because they are generally the shortest. Rarely do its leaves reach 12 cm and lengths of less than 10 cm are not uncommon. Even then there is overlap with other subspecies. For example, some populations of ssp. *pruinosa*, particularly those of the Barossa Valley and the Southern Flinders Ranges, have adult leaves similar in length to those of ssp. *stephaniae*. By contrast, those of other populations of ssp. *pruinosa* in Central Victoria can be the longest within the species. Field studies of numerous populations in this region have found individual trees with leaves nearly 20 cm long. Subspecies *leucoxylon* also has a wide range of adult leaf lengths. Leaves in some populations could be classed as markedly long. In the Mt Lofty Ranges and on the Fleurieu Peninsula individual trees with longest leaves exceeding 16 cm were not uncommon. Across the northern fringes of the Grampians even longer leaves were observed. However, like ssp. *pruinosa*, the lower limit of the range in ssp. *leucoxylon* overlaps with ssp. *stephaniae* and there is only a very limited scope for using leaf lengths to distinguish between the two subspecies. The ranges of lengths of ssp. *megalocarpa*, ssp. *petiolaris* and ssp. *connata* fall within those of both of ssp. *pruinosa* and ssp. *leucoxylon* and also overlap with ssp. *stephaniae*.

SURFACE WAX:

Some specimens of ssp. *pruinosa* have been identified as ssp. *leucoxylon* because they exhibit no adult wax. This condition is not uncommon in populations in the Barossa Valley and northwards. In fact, adult surface wax in these populations is regularly only light. By contrast, in populations of the subspecies in South-east South Australia and Central Victoria, the other main centres of distribution, surface wax is usually heavy and there is little scope for confusion with other subspecies. Despite the variability in adult surface wax, all normal seedlings of the subspecies are uniformly waxy.

DISTRIBUTION PATTERNS:

The notion that infraspecific taxa within *E. leucoxylon* correspond with coastal, subcoastal and inland climates to some extent is an oversimplification. Most of the subspecies have populations on the extremities of their distributions or outliers which disobey these prescriptions. For example, ssp. *megalocarpa*, which is thought of as being coastal, has inland populations in South-east South Australia, and ssp. *leucoxylon*, previously considered as sub-coastal, has coastal populations on Kangaroo Island and the Fleurieu Peninsula and inland populations in Western Victoria. Further, ssp. *connata* is both subcoastal and coastal, whilst both ssp. *pruinosa* and ssp. *stephaniae*, which are essentially inland forms, have populations in close proximity to the coast in South-east South Australia.

CULTIVARS:

Of considerable interest to the infraspecific taxonomy of *E. leucoxylon* is the horticulturally exploited form known as var. "*rosea*" or less often var. "*macrocarpa rosea*" or "dwarf". Whilst it breeds true, except for flower color, and is morphologically distinct, its origins are obscure and it can have no taxonomic

status. It is one of the most widely planted ornamental eucalypts in Victoria and South Australia and its features dominate many enthusiasts' understanding of the species. Some observers have confused it with ssp. *megalocarpa* and others have suggested that it has been derived from ssp. *petiolaris*. However, its slender leaves of less than 10 cm, relatively large, cylindrical fruits with the sunken style base and alternate, subpetiolate juvenile leaves are distinctive. If a parent population does exist and could be located, the form would be entitled to a subspecific status.

ABERRATIONS:

The incidence of aberrant seedlings in *E. leucoxylon* has been discussed above where it was suggested that they were of hybrid origin. This phenomenon has been observed in many of the populations sampled for seedling trials and was a feature which occurred in varying frequencies in seedlings of most provenances of both ssp. *connata* and ssp. *pruinosa*.

Seven-budded inflorescences also occur in small numbers in many populations within the species. Boland noted this and made particular reference to the Jeparit area where he suggested there may have been an influence from *E. largiflorens*. Of the many occurrences throughout the species, the feature is most common in the populations of the western extremity of ssp. *stephaniae*. It is also suspected that these cases may have originated from hybrids, with *E. fasciculosa*, which is invariably in the vicinity or even an associate, as the other parent. Where the feature occurs in populations of ssp. *connata*, *E. melliodora* is usually an associated species. In fact, hybrids with that species are not uncommon.

FUTURE STUDIES:

The Boland study of 1978 and the contributions of Boomsma (1981) have opened the door to a greater understanding of *E. leucoxylon*. The study reported in this paper should be regarded as an extension of those works. Even with the erection of the two new subspecies it would be naive to assume that the species has been fully treated. Its ability to adapt to a wide range of soils and climates suggests that other previously unnoticed forms might exist.

In the meantime, investigations of the known taxa are continuing and it is anticipated that a greater understanding of the infraspecific relationships within the species will be reached. An important aspect of this ongoing process is the reassessment of the taxonomic disposition of the markedly divergent ssp. *petiolaris*.

ACKNOWLEDGEMENTS

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A NEW SPECIES OF *CALOTIS* R. Br. (ASTERACEAE: ASTEREAE) FROM NEW SOUTH WALES.

by

P. S. SHORT*

ABSTRACT

Short, P. S. A new species of *Calotis* R. Br. (Asteraceae: Astereae) from New South Wales. *Muelleria* 7(3): 405–410 (1991). — *Calotis moorei* P. S. Short, is described and illustrated and notes on its distribution, possible breeding system, and relationships are provided.

TAXONOMY

Calotis moorei P. S. Short, *sp. nov.* affinis *C. cymbacanthae* F. Muell., sed aristis fructuum 4–8 differt, a *C. erinacea* Steetz, foliis caulibusque pilosis differt.

HOLOTYPUS: 'Mt Mulyah' — about 80 km northwest of Louth. (Near homestead). 30°19′S, 144°32′E. Deep red brown sand. 26.ix.1984, *C. W. E. Moore 8454* (CANB 354246). ISOTYPUS: (NSW, *ex* CANB 354245).

[*Calotis erinacea auct. non* Steetz; Davis, Proc. Linn. Soc. New South Wales 77: 164 (1952), as to *Officer s.n.* (NSW 14995).]

Perennial herb, 10–45 cm high, major axes ascending to erect, with septate hairs. *Leaves* alternate, mainly long-spathulate or oblanceolate to obovate but at least the upper ones lanceolate to ovate, 0.5–7 cm long, 0.2–1.4 cm wide, with 1–8 coarse teeth or lobes, or entire, with septate hairs. *Capitula* solitary, terminal, heterogamous, essentially radiate, but 4–5 of the innermost female 'ray' florets with 2–3 irregular corolla lobes and sometimes with one or more malformed anthers. *Involucre c.* 6–9 mm diam.; bracts, 12–14, in *c.* 2 rows, ovate, 2.6–3.9 mm long, 0.8–1.7 mm wide, outer surface with septate hairs, the margins with both septate, non-glandular and multicellular, glandular hairs, inner surface with septate glandular hairs, apex sometimes with a tuft of septate hairs. *Receptacle* very widely ovoid, with scale-like protrusions. *Ray florets* female, 26–33; corolla usually strap-like, 4.5–5.8 mm long, 1.2–1.6 mm wide, yellow; style arms lanceolate. *Disc florets* male, 19–25, corolla 1.8–3 mm long, lobes 4–5, yellow; stamens 4–5; anthers 1.3–1.6 mm long, microsporangium 1.1–1.2 mm long, terminal appendage 0.2–0.27 mm long; style arms not or barely divided. *Fruits* homomorphic, brown; body flattened, broadly cuneiform or widely obdeltoid, the exposed portion 1.3–2.2 mm long, 1.2–1.5 mm wide, tuberculate on each face, enclosed apically by the expanded bases of the awns; awns (3)4–8, equal in length or variable, *c.* 0.4–3.3 mm long, barbed along their whole length and hairy within the cup. (Figs 1, 2)

DISTRIBUTION:

Calotis moorei is apparently confined to New South Wales. Apart from the type locality, *i.e.* near the homestead of 'Mt Mulyah' sheep station, the only other collection known to me was gathered by E. Officer (NSW 14995) from the locality of 'Zara' (35°10′S, 144°35′E), about 480 km south of 'Mt Mulyah'.

*National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141

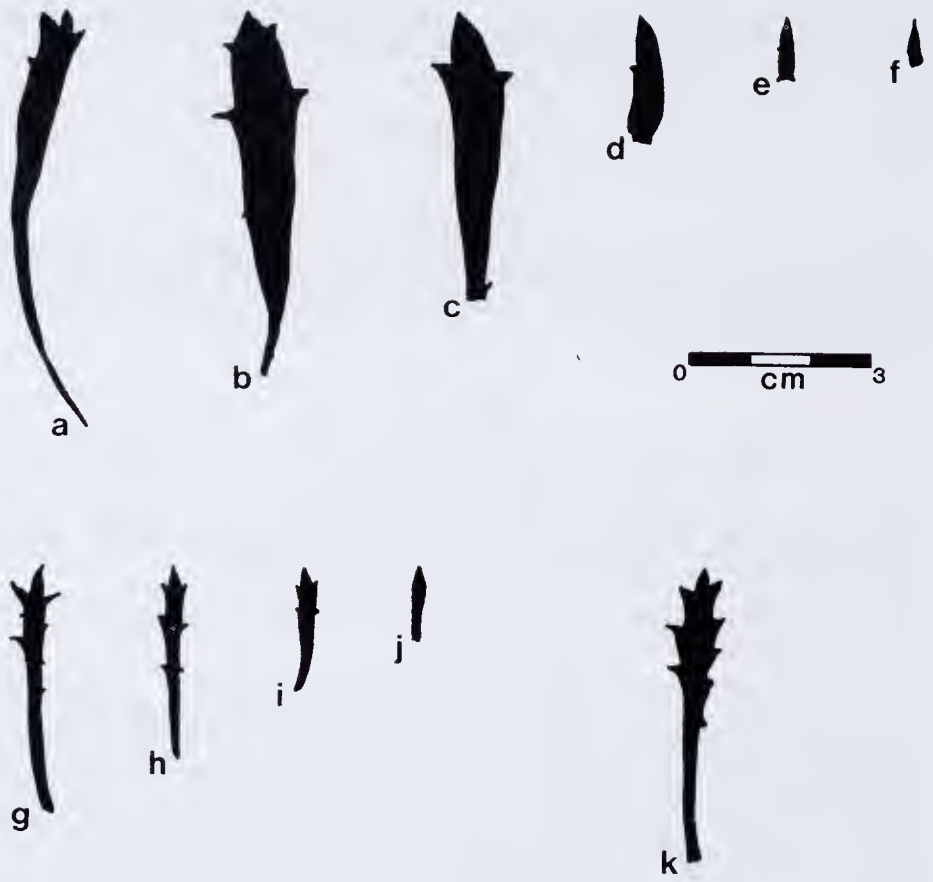

Fig. 1. Leaf variation in *C. moorei*. a–f — basal to upper leaves from the holotype specimen; g–j — basal to upper leaves in *Moore 5238*; k — mid-leaf from *Moore 5149*.

Fig. 2. Fruit of *C. moorei*, ×6 (from holotype).

HABITAT & CONSERVATION STATUS:

Herbarium labels only record that *C. moorei* grows in 'red brown fine sand'. It has since been ascertained (C. W. E. Moore, *in litt.* 1990) that the population from which the type, and apparently other collections from 'Mt Mulyah' were gathered, grows on an extensive, relatively flat area, on the upper level of low sandhills. The original vegetation was probably *Acacia cambagei* woodland but no such trees remain. When the various collections were gathered scattered plants of *Dodonaea viscosa* subsp. *angustissima,* mostly in early stages of growth, were present. Mr Moore has also informed me that he doubts that he has seen plants that have survived for more than two years and that he has not seen any regeneration of *C. moorei* since 1984. He suggested that this may be because of the invasion of *Dodonaea,* which tend to prohibit growth of herbs. He further recorded that 'recently a portion of the area has been cleared using the blade plough, and perhaps there will be another population of *Calotis*, if the seed remains viable long enough'. These notes suggest that *C. moorei* is, very much, an endangered taxon.

ETYMOLOGY:

The specific epithet honours retired ecologist, Mr C. W. E. (Ted) Moore (1908–), who has worked extensively in western New South Wales, particularly around Bourke and Louth (J. G. West *in litt.* 1990). He gathered all but one of the collections of this species, arranged for their loan from CANB, and provided additional notes on the type locality.

NOTES:

Stace (1978), on the basis of number, size and configuration of chromosomes, recognised six species groups within *Calotis*. Her 'Group IV' contained five species, *i.e. C. cymbacantha* F. Muell., *C. erinacea* Steetz, *C. lappulacea* Benth., *C. latiuscula* F. Muell. & Tate, and *C. suffruticosa* Domin. A further species, *C. kempei* F. Muell., was not examined by Stace (1978) but various morphological features also suggest that it belongs to this group.

As well as cytological similarities all members of this group occur in arid and semiarid regions of Australia, and have yellow ray florets, a feature absent from other species of *Calotis*. All, with the possible exception of *C. cymbacantha*, are perennial herbs. *C. cymbacantha* is generally described as an annual.

Although it has not been examined cytologically *C. moorei* is clearly a member of this group. Morphologically its strongest affinities are with *C. cymbacantha* and forms of *C. erinacea*. Both species have been collected from 'Mt Mulyah' (C. W. E. Moore, *in litt.* 1990).

Calotis moorei is seemingly a perennial which flowers in the first year of growth and, at least at this stage, is vegetatively similar to *C. cymbacantha.* The leaves in both taxa are of similar size and shape and have an indumentum of septate hairs (Fig. 1). The fruit also share some features, *i.e.* a tuberculate body terminating in awns, but differ in awn number (Figs 2 & 3), the only definite feature by which the two taxa can be distinguished from each other. In *C. cymbacantha* the fruit usually have just two awns (Davis 1952, figs 58–60). Occasionally a few three-awned, as well as two awned fruit, may be found in the one capitulum. Three-awned fruit have been observed in *C. moorei* but the majority, including those within the same capitulum as three-awned fruit, have four or more prominent awns (Fig. 3).

In *C. cymbacantha* the awns are of equal length, except in the sporadically occurring three-awned fruit in which one awn may be considerably shorter than the other two. In *C. moorei* awns may be of similar length, particularly in four-awned fruit, or be extremely variable in length. For example, in seven or eight awned fruit several awns may be about 3 mm long but one or two may be little more than a short tooth about 0.4 mm long.

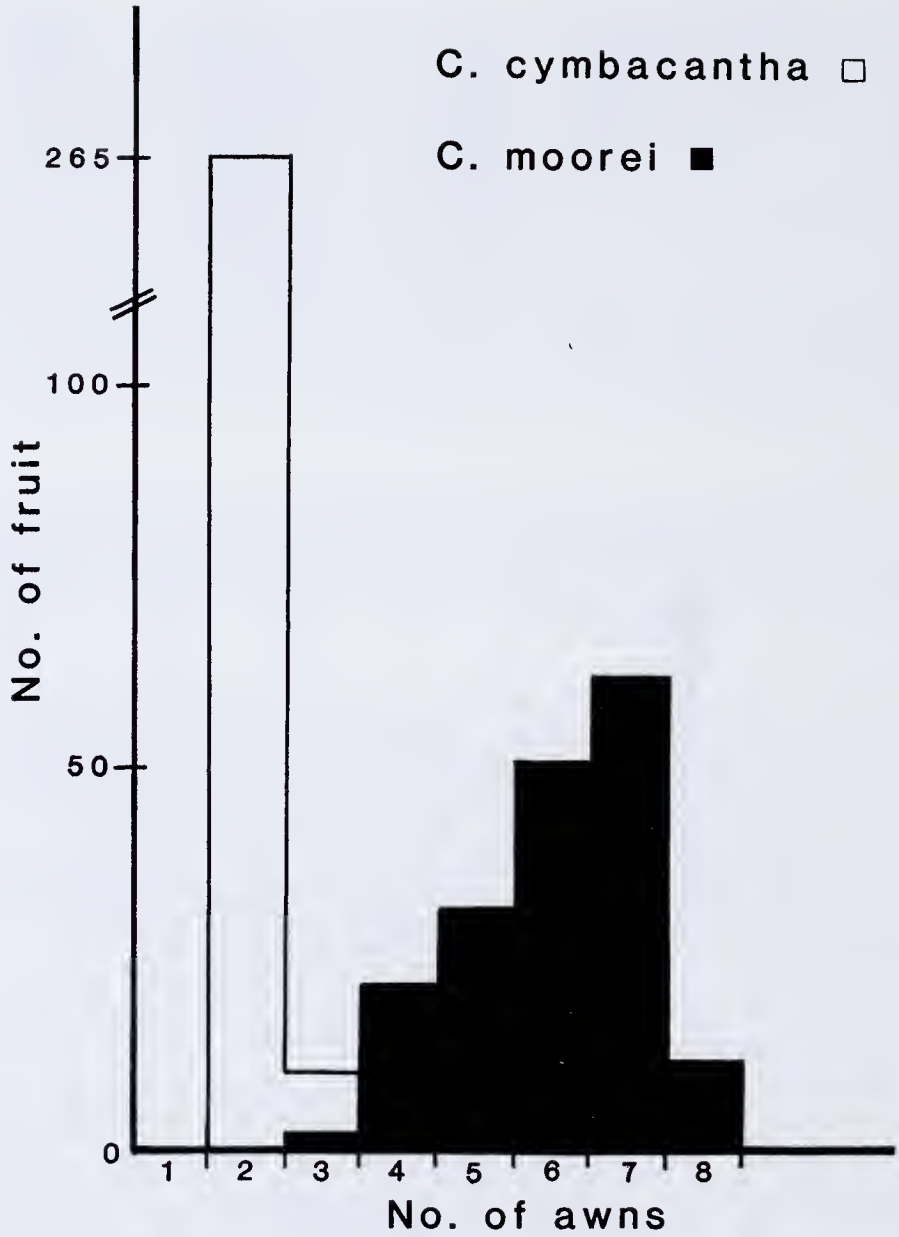

Fig. 3. The number of awns in fruit of *C. cymbacantha* and *C. moorei*.

Calotis moorei is not dissimilar vegetatively to some forms of *C. erinacea*, although in that species the branches and leaves are glabrous, not septate hairy. Both species may also have the same number of awns on the fruit, but in *C. erinacea* the body of the fruit is smooth, not tuberculate (Davis 1952, figs 43–47).

The conspicuous yellow ray florets indicate that this species commonly cross-pollinates and, as some florets may each produce several thousand pollen grains, there seems little doubt that cross-pollination can occur. However,

staining with phloxine/methyl green, suggests that the percentage of fertile pollen produced ranges from 0–80%. It has also been observed that a full complement of fruit are set within each capitulum.

High ploidy levels have been previously reported in 'Group IV' members of *Calotis*. *C. cymbacantha* has $n = 7$ & 14, *C. erinacea* $n = 7$, 14, 21 & 28 (Stace 1978). Stace's data suggests that, in the vicinity of 'Mt Mulyah', *C. cymbacantha* has $n = 14$ ($4n$) and *C. erinacea* $n = 28$ ($8n$).

C. lappulacea, a member of this group, is apparently an obligate apomict with somatic apospory (Davis 1968), as may be a further member, *C. suffruticosa* (Stace 1978).

Morphologically, *C. moorei* shares a number of attributes with *C. cymbacantha* and *C. erinacea*. This observation, together with those on pollen fertility and fruit set, plus the substantiated chromosome numbers and apomixis in related species, suggest that *C. moorei* may be of hybrid origin, is an apomict, and perhaps has $n = 21$ ($6n$).

I accept herein the specific status of *C. moorei* but do so with some reservations. Although the taxon is morphologically distinct, and no less distinct than many other species of *Calotis*, it may not be equatable with a stable, self-perpetuating taxon to which the rank of species is usually applied. Instead, it may be a hybrid apomict which is produced from time to time in disturbed habitats. Therefore, it is not difficult to argue that this taxon should not be formally given the rank of species. However, at least the hybrid derivation of this taxon is speculation, and the treatment of apomictic taxa is something that will always be controversial.

It also seems from MEL collections, and the account by Davis (1952), that the related species, *C. erinacea*, contains some distinctive entities which could be formally recognised. There is considerable variation in the number of awns on the fruit and differences may be geographically correlated. Ideally, these entities should have been more critically examined before the question of the rank of the taxon described here was decided upon. However, I am not in a position to carry out such a revision. Instead, my attention has been drawn to what is a rare taxon, one that could seemingly, and all too readily, join the ever increasing ranks of extinct taxa. I believe it of paramount importance to draw attention to such taxa by describing and formally naming them. The possibility that at a future date it may be decided that the name of the taxon should be *C. x moorei*, or that an infraspecific category should be adopted, is less important.

SPECIMENS EXAMINED:

With the exception of the isotype (NSW), and duplicates of *Moore 4986* (MEL 695833) and *Moore 5149* (MEL 695832), all specimens of *C. moorei* collected by C. W. E. Moore from 'Mt Mulyah', between 1967 and 1984, are housed at CANB, *i.e. Moore 4986, Moore 5149, Moore 5238* (4 sheets), *Moore 5498, Moore 5499, Moore 5918, Moore 6429*. The only other specimen of this species examined was *Officer s.n.* (NSW 14995) from 'Zara'.

Specimens of other species examined are housed at MEL.

ACKNOWLEDGEMENTS

I thank Mr Ted Moore for providing specimens and relevant data; Dr Judy West for providing some biographical notes on Mr Moore and for arranging the distribution of duplicate collections to MEL and NSW; Mr Neville Walsh for comments on the Latin; Dr Elizabeth Brown for arranging the loan of *Calotis* specimens from NSW, and for information on the locality of 'Zara'; and Anita Barley for providing the illustration of the fruit of *C. moorei*. He may not agree with my conclusions on the status of *C. moorei* but Dr Laurie Haegi made valuable comments on the manuscript.

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BOOK REVIEW

Plants for Medicines: a chemical and pharmacological survey of plants in the Australian region. D.J. Collins, C.C.J. Culvenor, J.A. Lamberton, J.W. Loder and J.R. Price. Published by CSIRO Publications, Melbourne. 1990. 303 pp. including 443 line illustrations and 64 colour plates. ISBN 0 643 04992 7 (Casebound). Price $AU70.00.

In 1940, at the request of the Medical Equipment Control Committee of the Army and the National Health and Medical Research Council, an organised investigation of the Australian flora was initiated by the then Council for Scientific and Industrial Research on account of the war-time need to find local sources of several essential drugs of plant origin. An important stimulus to this investigation was the earlier successful production in Australia of hyoscine for use in ophthalmology from indigenous Queensland *Duboisia* species. After the war the screening of the Australian flora for new compounds of commercial value became an important CSIRO project. The relative ease of obtaining interesting new chemical compounds from the unique flora, which was poorly known phytochemically, induced many chemists in Australian Universities to participate in the project. A collaborative effort by chemists from CSIRO and Australian Universities grew from this mutual interest and became known as the Australian Phytochemical Survey.

The phytochemical investigations most closely associated with the CSIRO screening programmes were those on alkaloids, tumour inhibitors and toxic constituents affecting livestock. Initially attention was focused on the rain-forest species of Queensland and northern New South Wales because early testing indicated that a higher proportion of alkaloid-containing species occurred in these areas. Special interest was attached to the investigation of alkaloid-positive species from plant families and genera which had not previously been found to contain alkaloid-yielding species as these were considered to be the most likely source of new and unusual types of alkaloids. Other criteria for selecting species with promising physiological activity were their use by Aborigines as medicines or poisons, and, on account of the predictive value of alkaloid character, species closely related botanically to others of known drug sources. In 1958 screening was extended to Papua New Guinea and some screening was also carried out in Central and Western Australia.

Over the years the results of many chemical studies undertaken during this Survey have been published in diverse scientific journals and books but no overall account of the Phytochemical Survey and the screening results has appeared. The publication of the main screening results on almost 2000 species in 'Plants for Medicines ...' is welcomed as it brings together for the first time a wealth of phytochemical information on the Australian flora and at a time that coincides with of a resurgence of interest in this field.

'Plants for Medicines ...' consists of a Preface and Eight chapters. Chapter 1 briefly outlines the background to the phytochemical survey and CSIRO screening programme and summarizes the highlights of the studies. Structural diagrams are interspersed where appropriate through the text in Chapters 1 to 4. It is of interest that *Acacia* and *Eucalyptus*, the two largest genera in Australia, yielded very disappointing results; some simple alkaloids were found in species of *Acacia* but none has been isolated from a species of *Eucalyptus*.

The alkaloid and anti-tumour screening results are presented in Chapter 2. The screening for alkaloids was conducted by the CSIRO Division of Organic Chemistry (later Applied Organic Chemistry) as part of its collaborative programme with the American pharmaceutical company, Smith, Kline and French. The screening results presented in Table 2.1 occupy 48 pages. The identification of all species tested were verified at the time of collection or subsequently by staff of State or Commonwealth herbaria. Over a period of almost fifty years, as one would expect, the names of many of the plants changed

and there were significant changes in chemical methodology. It is to the credit of the authors that prior to the publication of this book every endeavour was made to provide contemporary nomenclature for all plants tested. In this regard, the assistance of State, Territory and Commonwealth herbaria was sought. The names by which the plants were known at the time the chemical examination was carried out are retained in parenthesis so that names can be correlated with records and published chemical studies. In the screening list and in other sections of the book the species are arranged alphabetically within genera, the genera alphabetically within families and the families are arranged alphabetically. The family circumscriptions for higher plants are those of Cronquist. Table 2.1 lists the name of the species, the locality from which the material was collected, the name of the collector and the collecting number, the parts of the plant analysed, the screening methods, whether there is a report on pharmacological testing of alkaloids in Chapter 3, whether the plant or total extract was screened for anti-tumour activity and whether further investigation of anti-tumour activity is provided in Chapter 4. The majority of species tested were vouchered and the vouchers were deposited in herbaria or in the CSIRO Division of Animal Health, Melbourne.

Chapter 3 deals with the Pharmacology of Alkaloids. The test procedures are outlined, and Table 3.1 lists the species investigated and the main activities observed. Detailed results for each species mentioned in the Table follow.

Chapter 4 covers the Anti-tumour Constituents. Table 4.1 lists the test tumours used in primary screening of pure chemicals and plant extracts, and Table 4.2 lists the anti-tumour species and their active fractions or constituents. Detailed results for each species follow Table 4.2. The results of tests on three groups of compounds are summarised in Tables 4.4, 4.5 and 4.6.

The volume is enhanced by the inclusion in Chapter 5 of sixty four colour plates, twelve of them reproductions of illustrations of species of phytochemical interest from Banks' 'Florilegium'. The remaining plates are of species examined during the course of the Phytochemical Survey. Thirty two of the photographs are by Keith Williams, three quarters of which have appeared in his Native Plants of Queensland volumes 1 (1979) and 2 (1984). By and large the photographs have reproduced well although some appear to have an excess of blue so that the colours are not quite true. The plate of *Borya septentrionalis* on p.178 is disappointing.

Chapter 6 consists of a bibiliography of over 2000 papers published between 1940 and 1987 on the chemistry and related studies of Australian plant constituents. The bibliography of 70 pages relates mainly to plants indigenous to Australia (bacteria, fungi, algae, lichens and higher plants) but also includes papers on introduced species which are naturalised or used in pastures and New Guinea plants. A further 51 references appear in Chapter 7. Associated with the publication of 'Plants for Medicine ...' is the creation of a Phytochemical Data Base and enquiries may be directed to the first named author at the Department of Chemistry, Monash University.

One of the strengths of 'Plants for Medicines ...' is that it is extremely well indexed. Chapter 8 is devoted to Indexes to the text and bibliography. 8.1 is an index to plant genera and provides access at genus level to the text and screening list. 8.2 lists the genera within each family for which information may be found. 8.3 is an index to the authors of the publications listed in the bibliography and 8.4 is an alphabetical index to the chemical structures. The presence of these Indexes makes it easy to find the relevant information being sought.

The text is set in 10/11 Garamond and is very clear. Proof reading is of a high standard and I have detected very few inconsequential minor typographical errors, for example, Cuconiaceae instead of Cunoniaceae on p. 134 and the use of *Flagellaria* as a family name instead of Flagellariaceae on p. 135. My botanical background precludes any comments on the chemistry component of the book.

'Plants for Medicines ...' is an extremely useful addition to information

about the Australian flora and is a great credit to the many scientists who contributed to the Australian Phytochemical Survey. By detailing the species for which some phytochemical information is available, 'Plants for Medicines ...' draws attention to those species which have not been studied at all. As probably only about ten per cent of the Australian flora has been studied phytochemically, it is hoped that the publication of 'Plants for Medicine ...' will stimulate further studies on our flora while there is still the opportunity to do so before populations vanish. In addition, the advances in methodology may well make it worthwhile to re-investigate some of the species studied years ago. 'Plants for Medicine ...' will be invaluable for phytochemists and those in the fields of pharmacy, toxicology, agriculture, aboriginal studies and taxonomic botany and is highly recommended. It is very pleasing to see the fruits of such a significant CSIRO-based project in print and the authors and publisher are to be congratulated.

J.H. Ross

BOOK REVIEW

A key to Australian Grasses. B. K. Simon. Published by Queensland Department of Primary Industries, Brisbane (1990). 156 pages, soft cover. ISBN 0 7242 3211 7. Price (including postage) $AU39.00.

The appearance of this recent publication makes available the first comprehensive key to the genera and species of Australian grasses since Bentham's 'Flora Australiensis' (vol. 7, 1878). Bentham's account dealt with 374 species of grass. Simon's book accounts for 1319 grass species, a testament to the activities of researchers such as himself in recognizing novelties in the Australian grass flora, and acknowledgement of a host of exotic species, both welcome and unwelcome, which have become established in this country.

The book is commendable for its simple layout. The introductory notes are followed by a modern classification of the Australian grasses (Subfamilies, Supertribes, Tribes, Subtribes, Genera), before, but not impingeing upon the keys to genera. Keys to species are then arranged in alphabetical order of genus, enabling the user who may already know the genus of any grass in question, to quickly find the appropriate pages without reference to the index. A frustration of most formal grass treatments is the varying systematic arrangements of genera and species in the text, which are often confounding to the non-systematist or any user who may eschew the use of an index. As the science of plant systematics in general and grass systematics in particular advances, so does the classification below family level become refined, and as a consequence, arrangements adopted by successive treatments rarely coincide. The alphabetical arrangement of genera provides stability and rationality to the non-systematist.

Important references to relevant works are given before most generic keys and an excellent bibliography of contemporary works, in itself a significant and useful compilation, appears before the index. Species names in current use, as well as recent synonyms and misapplied or rejected names (the latter in italicized print) are included in the index and their authorities given there.

The keys themselves are composed of couplets "constructed to be brief and unambiguous" which makes them attractive and generally simple to use. As an occasional consequence of their brevity however, features over which there may be some doubt are not supported by additional information as is often the case in wordier keys. For example, the stark alternatives of "annual" or "perennial" are used in both the genus and species keys. Either alternative is often readily established by one already with some experience in the group, but may be difficult for a relative novice. Similarly unreassuring are the couplets separable on a "more than or less than" character e.g. "ligule < 3 mm" opposed to "ligule > 3 mm" (*Stipa* key, couplet 51, p. 99). It is my experience with splits of this kind that the only remaining ligule on the plant to be identified is precisely 3 mm long! Reinforcement of solitary characters with other features allow the user to have more faith in their own progress and faith in the quality of the taxonomy with which they are faced.

Equally however, too much information in key couplets, approaching an abridged description of a typical specimen of a certain species, may induce some trepidation when attempting to key the (painfully frequent) atypical specimen. The perfect balance is seldom achieved and this book should not be criticized too strongly for erring on the side of simplicity, which in the vast majority of cases leads the user quickly and painlessly to an unambiguous conclusion.

In most cases, the keys are adapted from the most recent generic treatments which appear to have been accepted more or less uncritically. That is to say difficult genera (*e.g. Aristida, Danthonia, Deyeuxia, Eragrostis, Poa, Stipa,*), will not cease to cause headaches as a result of this work. This is not to diminish the significance of Simon's work, but emphasizes the intrinsic problems encountered when dealing with large, and in many cases, imperfectly known genera. To

critically revise all the representatives of the Poaceae in Australia, the most species-rich family of flowering plants in this country, is more than most present day botanists could hope to achieve in a lifetime.

A few errors/misprints/inconsistencies were noted and are briefly outlined here for the potential user of the keys.

Keys to genus (pp. 5–18).

P. 6, couplet 20: the lead to the genus *Thinopyrum* requires "rachis fragile", but in the species key *T. junceiforme* is keyed to by deciding "rachis not fragile".

P. 6, couplet: *Elymus* should not be marked as a naturalized genus.

P. 6, couplet 23: *Triodia* should be allowed to be keyed via both leads. *Triraphis* should also key following the first lead at 23.

P. 7, couplet 34: the two alternatives given are not mutually exclusive.

P. 12, couplet 127: *Deyeuxia* and *Dichelachne* generally have the lemma firmer than the lemma and may not be keyed here, although the ligule character should overcome this inconsistency.

P. 12, couplet 129: the second lead should direct to couplet 132, not 133.

Keys to species (pp. 19–108).

P. 61, couplet 63, *re Eragrostis tenuifolia:* the second part of the first couplet should read "inflorescence branches ciliate in their axils".

P. 65, *Erythranthera:* the distributions for *E. pumila* and *E. australis* are transposed.

P. 76, couplet 10, *re Panicum:* the second alternative should lead to 18, not 10.

At a time of increasing interest in Australia's diminishing grasslands and their component species, the appearance of this book is timely and should find a good market, although at $39.00 it is not cheap, but a price which, sadly, is becoming typical for specialist books.

Amateur and profesional agrostologists will welcome the publication of this book and Bryan Simon's contribution to the science should be warmly applauded.

N. G. WALSH

CONTENTS

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